NASA CR70589

DEVELOPMENT OF A TYPICAL MARS LANDING CAPSULE
STERILIZATION CONTAINER

Second Quarterly
TECHNICAL PROGRESS REPORT

Prepared by
RESEARCH AND DEVELOPMENT DIVISION
AVCO CORPORATION
Wilmington, Massachusetts

RAD-SR-66-14
NASA Contract NAS 8-20502
15 January 1966

Prepared for
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
GEORGE C. MARSHALL SPACE FLIGHT CENTER
Huntsville, Alabama

This Document Consists of
66 Pages 50 Copies,
Series A

DEVELOPMENT OF A TYPICAL MARS LANDING CAPSULE STERILIZATION CONTAINER

Second Quarterly
TECHNICAL PROGRESS REPORT

Prepared by
RESEARCH AND DEVELOPMENT DIVISION
AVCO CORPORATION
Wilmington, Massachusetts

Approved by

G. E. Kropa
Project Manager

RAD-SR-66-14
NASA Contract NAS 8-20502
15 January 1966

Prepared for
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
GEORGE C. MARSHALL SPACE FLIGHT CENTER
Huntsville, Alabama

CONTENTS

ILLUSTRATIONS

INTRODUCTION

This Second Quarterly Progress Report on the "Development of a Typical Mars Landing Capsule Sterilization Container" program, Contract NAS 8-20502, covers the work performed from 1 October 1965 to 1 January 1966, for NASA's George C. Marshall Space Flight Center. Mr. Ronald G. Crawford is the technical monitor.

During this period design efforts were completed and fabrication of test hardware was initiated. Basic fabrication of major assemblies are complete; final machining and finishing operations remain to be performed. Conventional manufacturing techniques were adequate for fabricating the sterilization container and model probe. All purchased items, except the "V" band clamp and electrical heaters for the simulated component boxes, have been received.

Thermal and structural mathematical models were developed and performance predictions were finalized. These are presented in the body of this report. They indicate low thermal stresses induced by the heat sterilization cycles and are not expected to induce permanent distortions. Minor permanent distortions are expected to occur as a result of relieving machining stresses.

The test plan outlined in the first quarterly report remains unchanged. Test fixtures were designed and their fabrication initiated.

Instrumentation types and locations were established. Data recording and reduction procedures were reviewed.

At this time no significant problems exist that would delay completion of this program as scheduled.

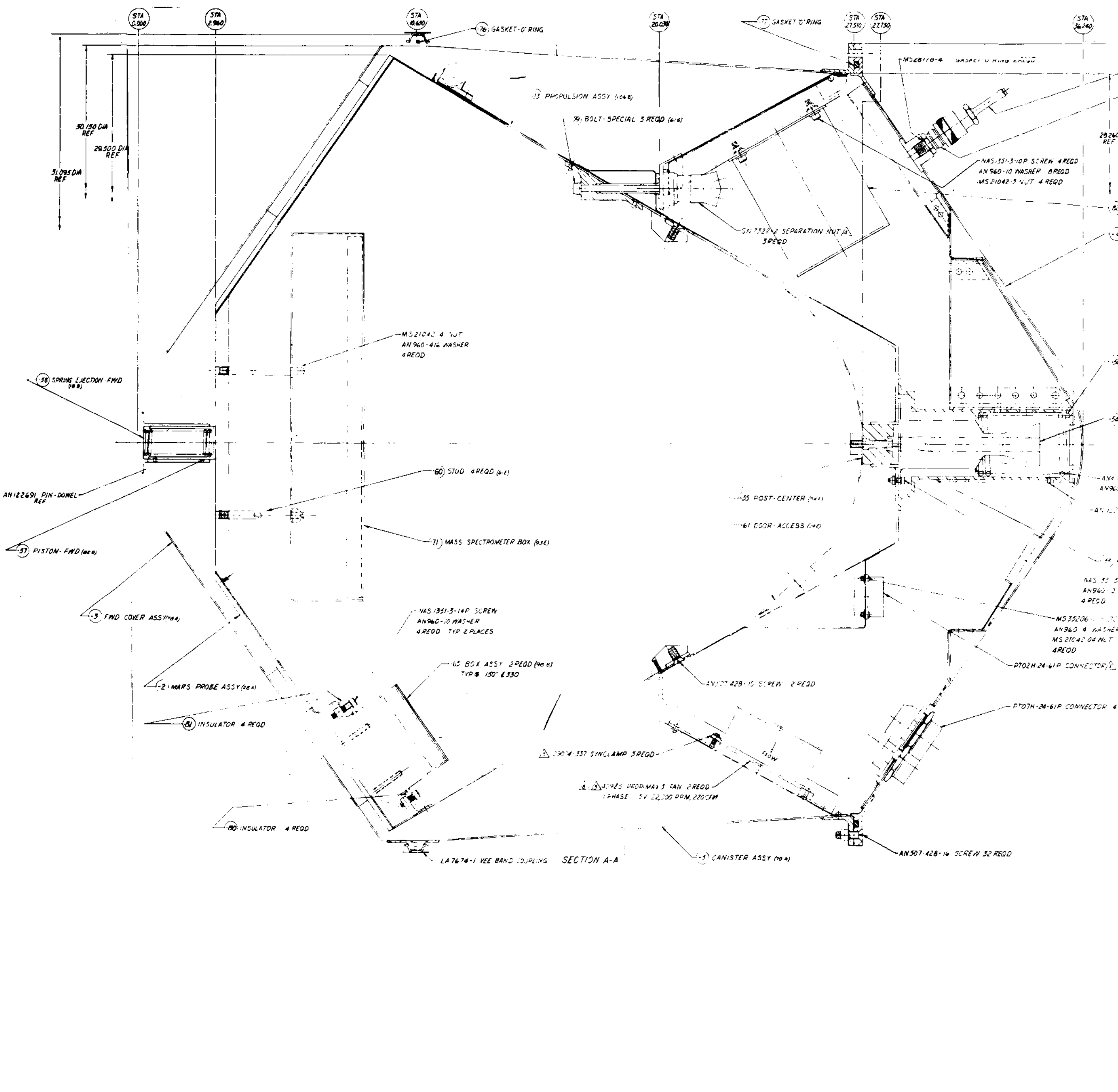
1. DESIGN

The design of the sterilization container and model probe assembly was completed in the second quarter. A thorough description of the design details was presented in the first quarterly progress report (RAD-SR-65-264). Figure 1 (A through H) represents the detailed layout (Avco Drawing 7676) to which the container and probe assembly is being manufactured. Current military standards were used to specify detail design features and fabrication techniques.

Minor departure from detailed layout drawings have been made to the configuration for manufacturing convenience and to minimize cost as fabrication progresses. No compromises that will affect the performance of the assembly are being made.

Design engineering is continually reviewing the fabrication status with shop personnel and all variations will be documented.

All purchased items have been ordered and are in shop stores awaiting final assembly. At the present time the only major items yet to be received are the "V" band clamp and the electrical heating blankets. These items have been promised for the end of January and should not delay the test program.


STA 0.000
STA 2.960
STA 10.690
STA 20.030
STA 27.510
STA 27.730
STA 34.240
76 GASKET-O' RING
77 GASKET 'O' RING
PROPULSION ASSY
39 BOLT-SPECIAL 3 REQD
30.150 DIA REF
29.500 DIA REF
31.095 DIA REF
NAS 1351-3-10P SCREW 4 REQD
AN 960-10 WASHER 8 REQD
MS 21042-3 NUT 4 REQD
SEPARATION NUT
3 REQD
MS 21042-4 NUT
AN 960-416 WASHER
4 REQD
58 SPRING EJECTION-FWD
AN 122691 PIN-DOWEL REF
60 STUD 4 REQD
57 PISTON-FWD
55 POST-CENTER
61 DOOR-ACCESS
71 MASS SPECTROMETER BOX
3 FWD COVER ASSY
NAS 1351-3-14P SCREW
AN960-10 WASHER
4 REQD TYP 2 PLACES
63 BOX ASSY 2 REQD
TYP @ 150° & 330
2 MAPS PROBE ASSY
INSULATOR 4 REQD
80 INSULATOR 4 REQD
PT02H-24-61P CONNECTOR
PT07H-24-61P CONNECTOR
SCREW 2 REQD
SYNCLAMP 3 REQD
FAN 2 REQD
FLOW
LA 7674-1 VEE BAND COUPLING
SECTION A-A
5 CANISTER ASSY
AN 507-428-16 SCREW 32 REQD

3 1

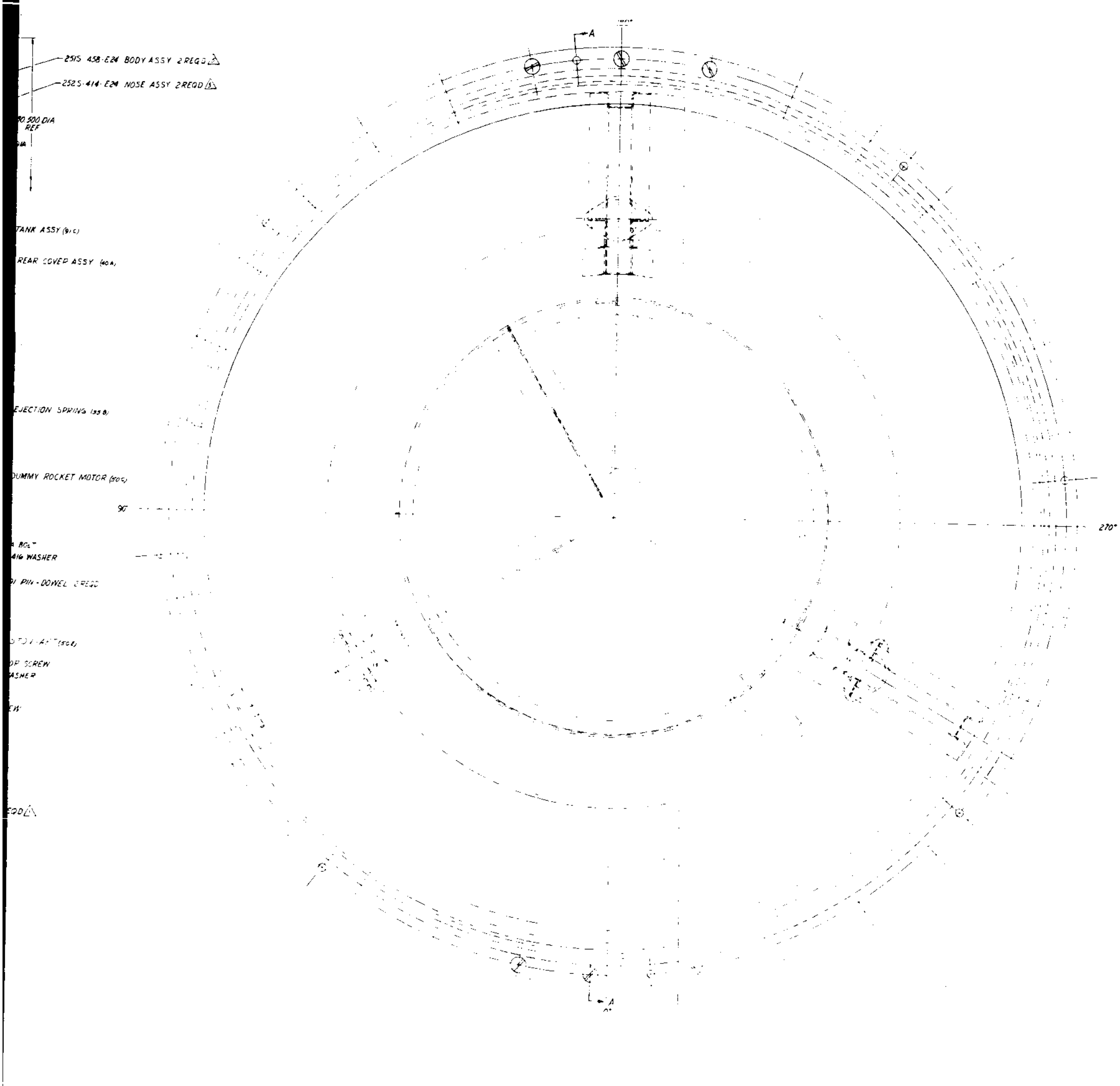


Figure 1 MARS PROBE AND STERILIZATION CANISTER ASSEMBLY
(A)

3 (2)

DASH NO	PART OR IDENTIFYING NO	NOMENCLATURE OR DESCRIPTION	ZONE
	CONT'D ON SHEET #2		
	NAS 551-3-14P	SCREW	
	NAS 551-3-5P	SCREW	
	NAS 1352-36-6P	SCREW	
	NAS 35-36-4P	SCREW	
	NAS 469-08-2	FASTENER	
	NAS 469-08-	FASTENER	
	NAS 1068 A4	NUT PLATE	
	NAS 1068 A3	NUT PLATE	
	NAS 1068 A06	NUT PLATE	
	MS 21209 F4-15	INSERT	
	MS 21209 F1-15	INSERT	
	MS 21209 [illegible]-5	INSERT	
	MS 20470 AD4-5	RIVET	
	MS 20470 AD4-4		
	MS 20426 AD4-9		
	MS 20426 AD4-6		
	MS 20426 AD4-5		
	MS 20426 AD4-4		
	MS 20426 AD3-9		
	MS 20426 AD3-6		
	MS 20426 AD3-4		
	MS 20426 AD4-7		
	MS 20426 AD2-3	RIVET	
	AN 122691	PIN-DOWEL	
	AN 960-10	WASHER	
	AN 960-6	WASHER	
	AN 507-428-16	SCREW	
	AN 507-428-10	SCREW	
	AN 505-4-5	SCREW	
	AN 4-13A	BOLT	
	LA 7674-1	VEE BAND ASSY	4A
	LA 7673-1	COVER-AFT	[illegible]
	LA 7672-1	COVER FWD	80E
-82		[illegible]	91C
-81		INSULATOR	94A
-80		INSULATOR	94A
-79		PAD CONNECTOR	99F
-78		PLUG	95A
-77		GASKET O'RING	94
-76		GASKET O'RING	94
-75		COVER	95F
-74		ANGLE	[illegible]
-73		SIDE	93F
-72		BASE	94F
-71		MASS SPECTROMETER	95F
-70		COVER	94B
-69		ANGLE	97E
-68		LEG	[illegible]
-67		SIDE	96D
-66		BASE	[illegible]
-65		BOX ASSY	95B
-64		TOP	[illegible]
-63		CYLINDER	97F
-62		BASE	97F
-61		DOOR ACCESS	94E
-60		STUD	[illegible]
-59		BOLT-SPECIAL	[illegible]
-58		SPRING EJECTION FWD	9B
-57		PISTON FWD	80D
-56		SPRING EJECTION AFT	94S
-55		CENTER POST	54F
-54		POCKET MOTOR DUMMY	50C
-53		PISTON AFT	50E
-52		ZEE RING	62A
-51		RING SUPPORT	25A
-50		PAD-MTG	28G
-49		RING-AFT	97F
-48		SHELL BODY	42

LIST OF MATERIALS OR PARTS LIST

DASH NO	NOMENCLATURE OR DESCRIPTION	ZONE
-47	HEAT SHIELD	31B
-46	SHELL NOSE	30D
-45	PLATE NOSE	[illegible]
-44	SPIN MOTOR-DUMMY	94E
-43	CLAMP SPIN MOTOR	99E
-42	PAD-SPIN MOTOR	99S
-41	[illegible] GUIDE	36S
-40	PIN-GUIDE	36G
-39	PAD-MTG	[illegible]
-38	BRACKET CONNECTOR	25A
-37	BRACKET MTG	[illegible]
-36		
-35	SHELL-AFT	104A
-34	RING AFT	23D
-33	PROPULSION ASSY	26A
-32	PAD	[illegible]
-31	HOUSING FWD SPRING	32F
-30	RING FWD COVER	56B
-29	BOX DUMMY	55E
-28	CLIP-AFT LH	63G
-27	CLIP-AFT RH	63G
-26	CLIP-FWD LH	63D
-25	CLIP-FWD RH	63D
-24	SUPPORT-FAN	76S
-23	PAD-FAN	68B
-22	HAT SECTION	76G
-21	SHELL INNER	66G
-20	SHELL OUTER	69F
-19	RING-SUPPORT	79S
-18	RING-AFT	54D
-17	RING-FWD	33F
-16	SUPPORT DOUBLER	44C
-15	RING DOUBLER	45A
-14	CLIP LH	51G
-13	CLIP RH	37G
-12	HAT SECTION	40S
-11	CLIP	49A
-10	GUSSET	46F
-9	[illegible]-SPRING	33A
-8	SUPPORT SPG [illegible]	43F
-7	RING STIFFENER	46B
-6	[illegible] REAR COVER	36F
-5	[illegible]	70A
-4	COVER ASSY-REAR	40A
-3	COVER ASSY-FWD	78A
-2	MARS PROBE ASSY	20B

LIST OF MATERIALS OR PARTS LIST

LTR	DESCRIPTION	DATE	APPROVED
A	INITIAL RELEASE		
B	[illegible] DIM & FID [illegible] 24-61P WAS [illegible] 24-61P, QTY 4 WAS 6 -80 & 81		
B1	ADDED .125 DIM TO -9		
B1	30° WAS 29° -30		
B1	.37 WAS .30 -25		
B1	ADDED NOTE 2 REF TO 63		
B1	ADDED 16.030 DIM -2 ASSY		
B1	17.310 DIM WAS 17.020 -2 ASSY		

REVISIONS

NOTES

14 THE STRESS APPROVAL SIGNATURE APPLIES ONLY TO THE STERILIZATION CONTAINER AND DOES NOT INCLUDE THE SIMULATED LANDER

PURCHASED FROM FASTENERS [illegible] MASSACHUSETTS

INSTALL [illegible] INSERT [illegible] .000-.010 BELOW SURFACE USING TOOL NO [illegible] INSTALL [illegible] KEY RING.

APPLY 400 SERIES 3M VELVET COATING COLOR [illegible] AS INDICATED AS PURCHASED FROM [illegible] MINING & MANUFACTURING CO. BAKE 30 MINUTES @ 250°F FOLLOWED BY 4 HOURS @ 310°F

PROTECT PAINTED SURFACES AGAINST OIL, GREASE [illegible] CONTAMINANTS IN ORDER TO PRESERVE EMISSIVITY CHARACTERISTICS

9 ALL ALUMINUM PARTS TO BE ALODIN [illegible] PER MIL-[illegible] TYPE [illegible] A OR B CLASS [illegible] PARTS SHALL BE HANDLED IN SUCH A WAY AS TO PREVENT ANY CONTAMINATION

INSTALL [illegible] WITH FLOW IN OPPOSITE DIRECTION

ALL THREADED FASTENERS TO BE TORQUE TO VALUES IN [illegible] UNLESS OTHER SPECIFIED

PURCHASED FROM PENN ENGINEERING & MANUFACTURING CORPORATION, DOYLESTOWN PA

5 PURCHASED FROM THE BRUNING COMPANY HIGHWAY [illegible] EAST BOX [illegible] LINCOLN, NEBRASKA

4 PURCHASE FROM HI-SHEAR CORPORATION 2600 WEST [illegible] STREET TORRANCE, CALIFORNIA, OR EQUIVALENT

PURCHASED FROM ROTRON MANUFACTURING CO., INC. WOODSTOCK, NEW YORK

TO BE POLISHED TO A SPECULATE LUSTER FINISH WITH HAND POLISHING OR BUFFING WHEEL [illegible] SCRATCHES ALLOWED

PURCHASED FROM BENDIX CORPORATION, [illegible] DIVISION SIDNEY, NEW YORK

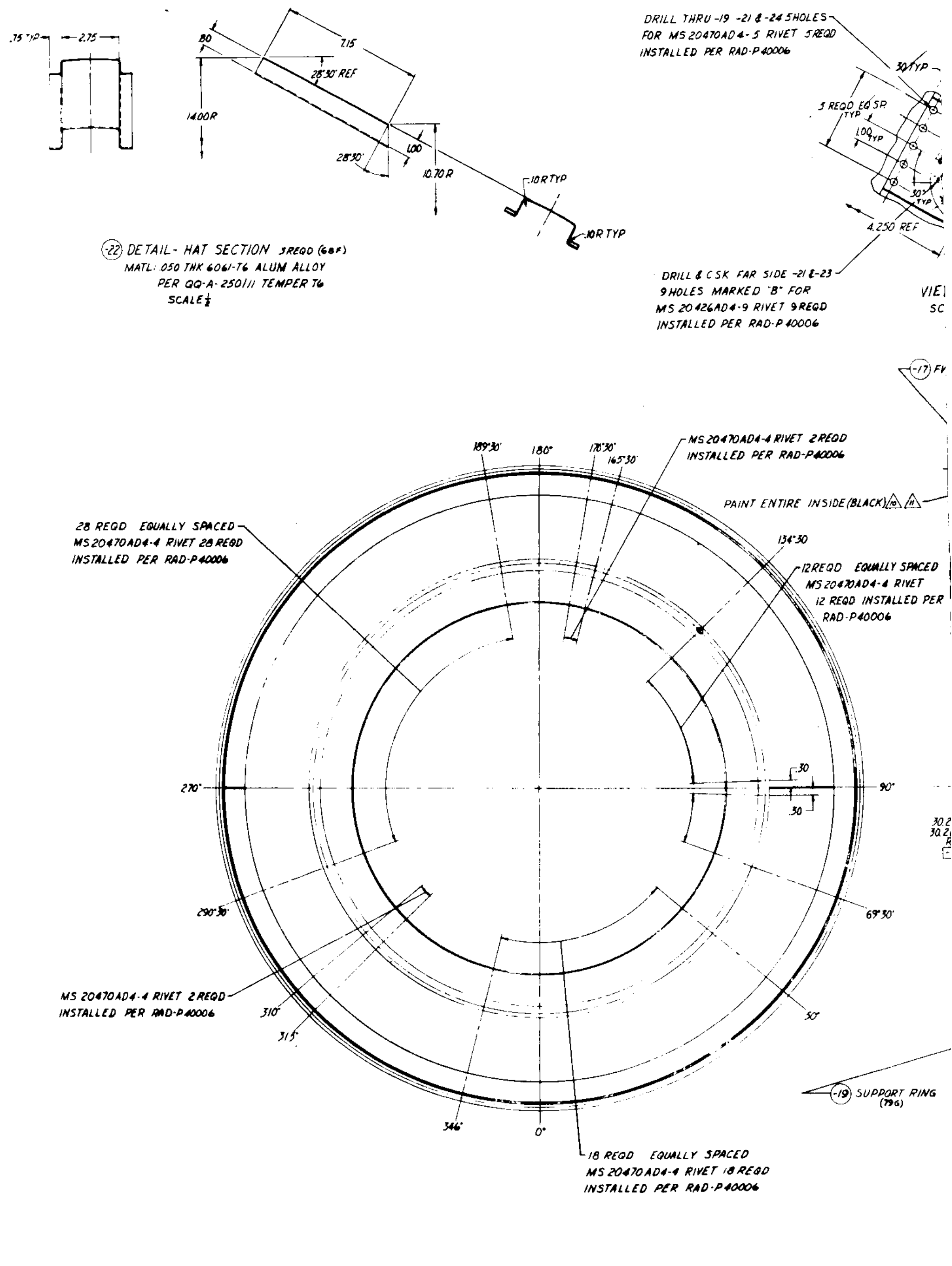
UNLESS OTHERWISE SPECIFIED

Avco CORPORATION

TITLE MARS PROBE & STERILIZATION CANISTER ASSY HUNTSVILLE

CODE IDENT NO 04614 | SIZE J | DWG NO LA 7671

SCALE ½ | SHEET 1 OF


(-22) DETAIL - HAT SECTION 3 REQD (68F)
MATL: .050 THK 6061-T6 ALUM ALLOY
PER QQ-A-250/11 TEMPER T6
SCALE ½
DRILL THRU -19 -21 & -24 5 HOLES FOR MS 20470AD4-5 RIVET 5 REQD INSTALLED PER RAD-P40006
DRILL & CSK FAR SIDE -21 & -23 9 HOLES MARKED "B" FOR MS 20426AD4-9 RIVET 9 REQD INSTALLED PER RAD-P40006
4.250 REF
MS 20470AD4-4 RIVET 2 REQD INSTALLED PER RAD-P40006
PAINT ENTIRE INSIDE (BLACK)
28 REQD EQUALLY SPACED MS 20470AD4-4 RIVET 28 REQD INSTALLED PER RAD-P40006
12 REQD EQUALLY SPACED MS 20470AD4-4 RIVET 12 REQD INSTALLED PER RAD-P40006
MS 20470AD4-4 RIVET 2 REQD INSTALLED PER RAD-P40006
(-19) SUPPORT RING (79G)
18 REQD EQUALLY SPACED MS 20470AD4-4 RIVET 18 REQD INSTALLED PER RAD-P40006

4 ①

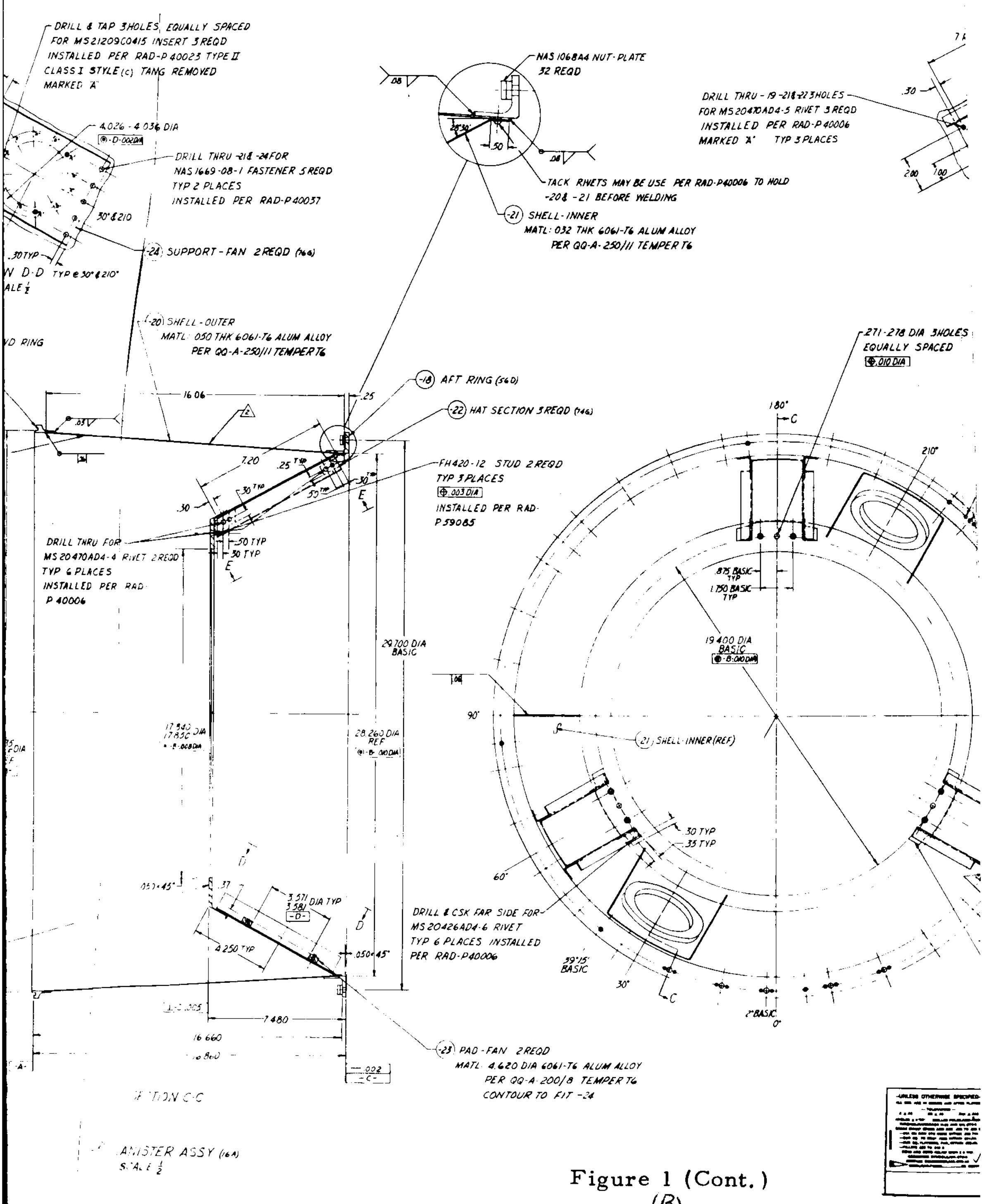
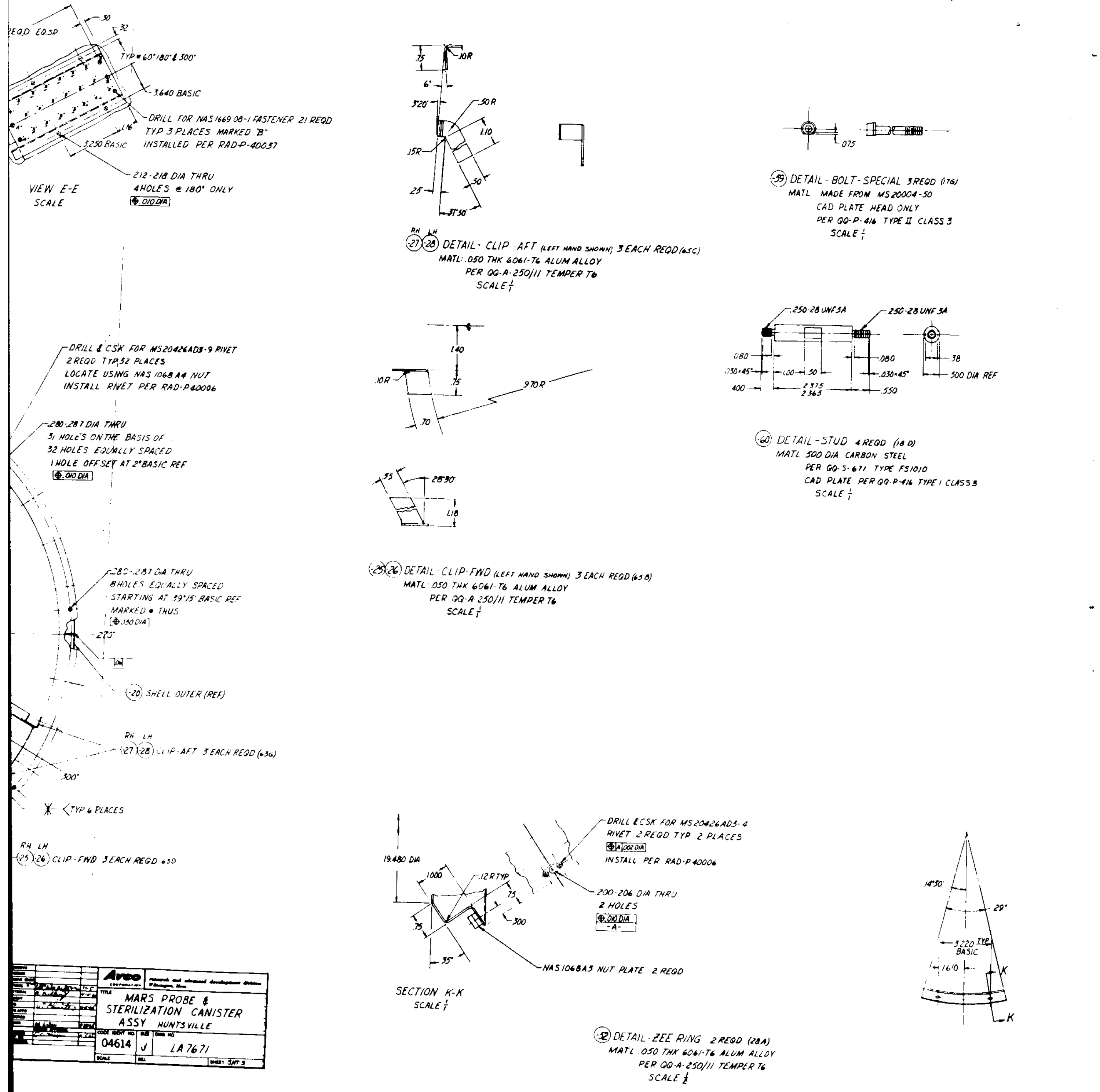
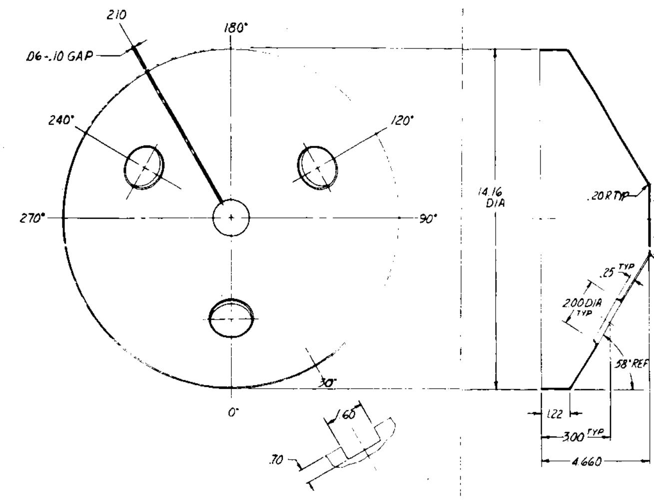


Figure 1 (Cont.)
(B)

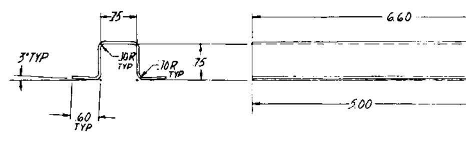
4

2

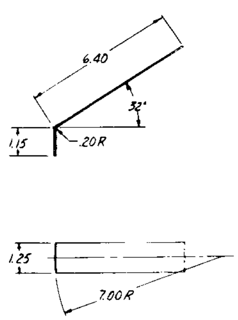

VIEW E-E
SCALE
TYP @ 60° 180° & 300°
3.640 BASIC
DRILL FOR NAS 1669 08-1 FASTENER 21 REQD
TYP 3 PLACES MARKED "B"
INSTALLED PER RAD-P-40037
3.250 BASIC
212-.218 DIA THRU
4 HOLES @ 180° ONLY
.010 DIA
RH LH
27 28 DETAIL - CLIP - AFT (LEFT HAND SHOWN) 3 EACH REQD (65C)
MATL: .050 THK 6061-T6 ALUM ALLOY
PER QQ-A-250/11 TEMPER T6
SCALE 1/1
59 DETAIL - BOLT - SPECIAL 3 REQD (17G)
MATL MADE FROM MS 20004-50
CAD PLATE HEAD ONLY
PER QQ-P-416 TYPE II CLASS 3
SCALE 1/1
.250-28 UNF 3A
.250-28 UNF 3A
.500 DIA REF
60 DETAIL - STUD 4 REQD (18 D)
MATL .500 DIA CARBON STEEL
PER QQ-S-671 TYPE FS1010
CAD PLATE PER QQ-P-416 TYPE I CLASS 3
SCALE 1/1
DRILL & CSK FOR MS20426AD3-9 RIVET
2 REQD TYP 32 PLACES
LOCATE USING NAS 1068 A4 NUT
INSTALL RIVET PER RAD-P40006
.280-.287 DIA THRU
31 HOLES ON THE BASIS OF
32 HOLES EQUALLY SPACED
1 HOLE OFFSET AT 2° BASIC REF
.010 DIA
.970 R
25 26 DETAIL - CLIP - FWD (LEFT HAND SHOWN) 3 EACH REQD (65B)
MATL .050 THK 6061-T6 ALUM ALLOY
PER QQ-A-250/11 TEMPER T6
SCALE 1/1
.280-.287 DIA THRU
8 HOLES EQUALLY SPACED
STARTING AT 39°15' BASIC REF
MARKED • THUS
.030 DIA
270°
20 SHELL OUTER (REF)
RH LH
27 28 CLIP - AFT 3 EACH REQD (63G)
300°
TYP 6 PLACES
RH LH
25 26 CLIP - FWD 3 EACH REQD 65D
DRILL & CSK FOR MS20426AD3-4
RIVET 2 REQD TYP 2 PLACES
A .002 DIA
INSTALL PER RAD-P40006
19.480 DIA
.12 R TYP
.200-.206 DIA THRU
2 HOLES
.010 DIA
-A-
NAS 1068A3 NUT PLATE 2 REQD
SECTION K-K
SCALE 1/1
14°50'
29°
3.220 TYP BASIC
1.610
K
K
32 DETAIL - ZEE RING 2 REQD (28A)
MATL .050 THK 6061-T6 ALUM ALLOY
PER QQ-A-250/11 TEMPER T6
SCALE 1/2
Avco
research and advanced development division
MARS PROBE & STERILIZATION CANISTER ASSY HUNTSVILLE
04614
J
LA 7671
SHT 3



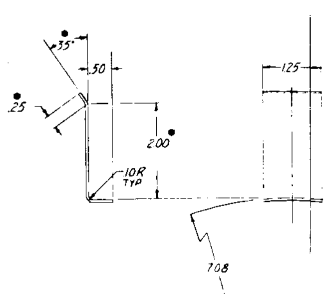
(-8) DETAIL - SUPPORT - SPRING HOUSING (37C)
MATL: .050 THK 6061-T6 ALUM ALLOY
PER QQ-A-250/11 TEMPER T6
SCALE ½



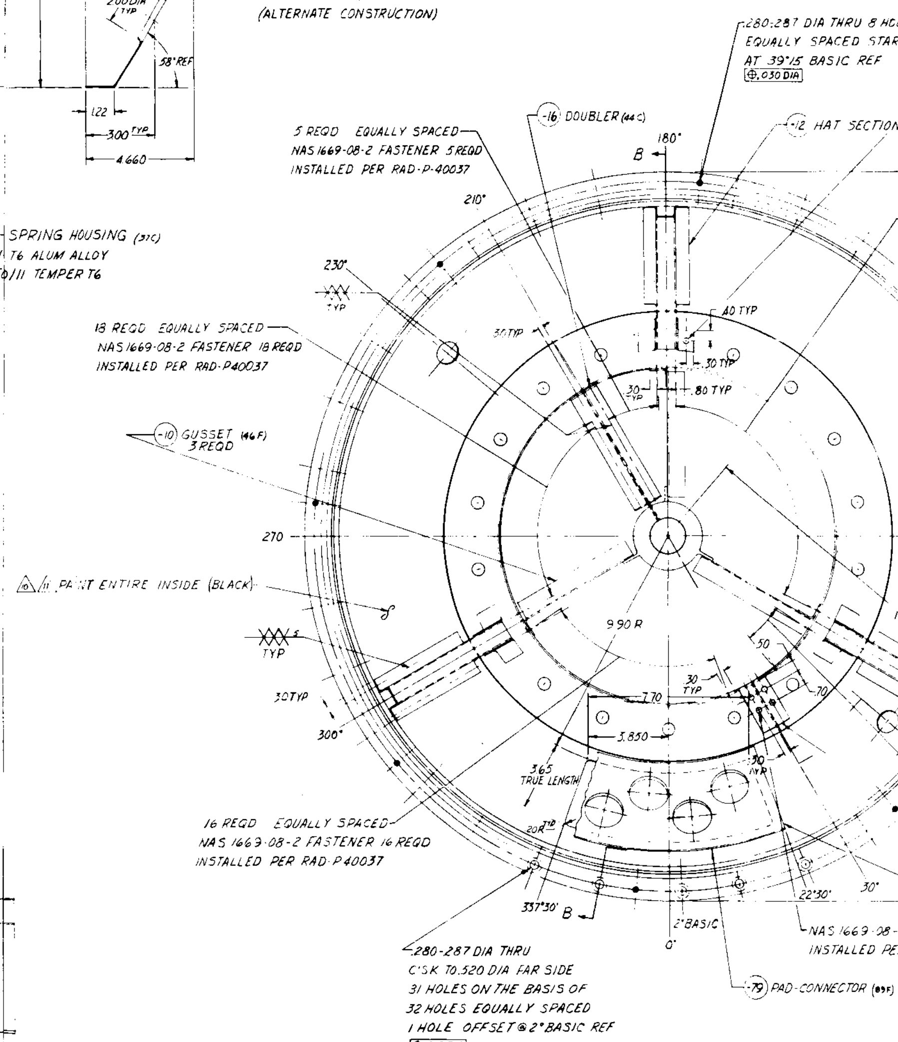
(-12) DETAIL - HAT SECTION - REAR COVER ASSY
MATL: .050 THK 6061-T6 ALUM ALLOY
PER QQ-A-250/11 TEMPER T6
SCALE 1/1



(-16) DETAIL - DOUBLER - SUPPORT (40 F)
MATL: .050 THK 6061-T6 ALUM ALLOY
PER QQ-A-250/11 TEMPER T6
SCALE ½



(-15) DETAIL - DOUBLER - STIFFENER RING (39C)
MATL: .050 THK 6061-T6 ALUM ALLOY
PER QQ-A-250/11 TEMPER T6
• TO BE BENT AT INSTL
SCALE 1/1



(-4) REAR COVER ASSY
SCALE ½

5 (-1)

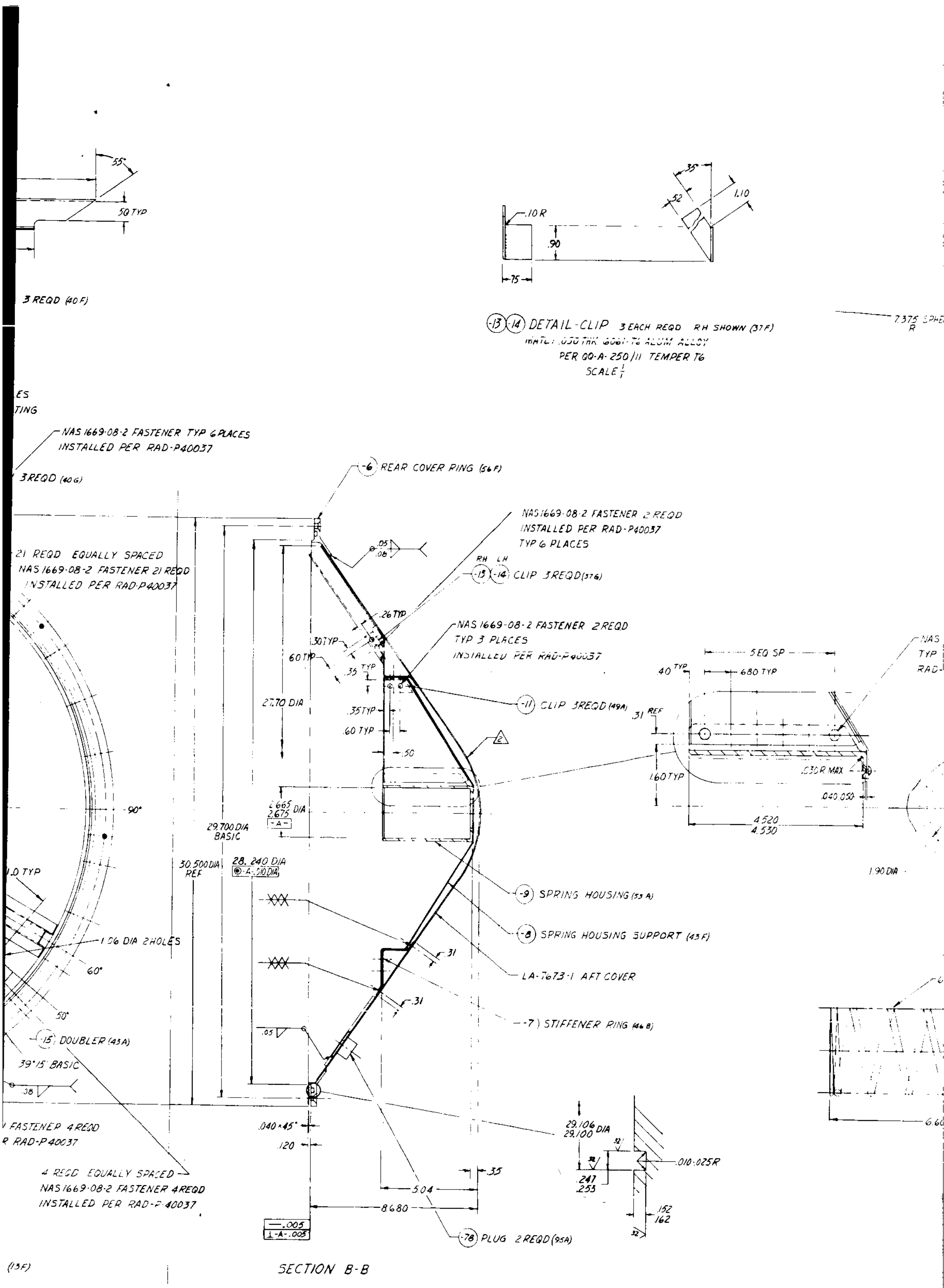
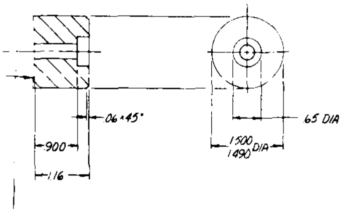


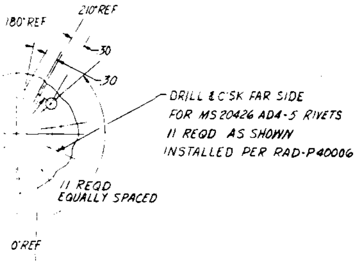
Figure 1 (Cont.)
(C)

5 ②



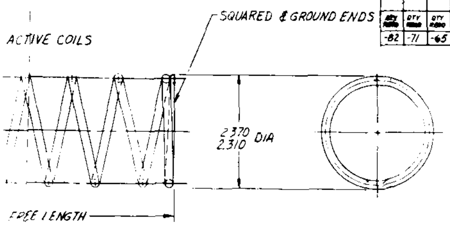
(55) DETAIL - POST-CENTER (16D)
MATL 6061-T651 ALUM ALLOY
PER QQ-A-250/11 TEMPER T651
SCALE $\frac{1}{1}$

1669-08-2 FASTENER 6 REQD
3 PLACES INSTALLED PER
P 40037



							2		MS28778-4	GASKET 'O' RING				
								4	MS35206-215	SCREW				
								4	MS21042-4	NUT				
								4	MS21042-04	NUT				
								4	MS21042-3	NUT				
								5	AN960-416	WASHER				
								4	AN960-4	WASHER				
							20		AN505-4-8	SCREW				
								3	SH200-2	BOLT CATCHER ASSY	ALUM ALLOY	3.030 LONG (4)		
					2				KR12-1	KEY RING	(B)			
					2				H13712-7-10	INSERT	(B)			
								4	PT07H-24-61P	CONNECTOR	(1)			
								1	PT02H-24-61P	CONNECTOR	(1)			
								3	SN 7322-2	NUT-SEPARATION	(4)			
	6	2							FH1032-20	STUD	(4)			
				6					FH420-12	STUD	(4)			
								9	109074-337	SYNCLAMP	(3)			
								2	40923	FAN	(3)			
								2	2525-414-E24	NOSE ASSY	(5)			
								2	2515-458-E24	BODY ASSY	(5)			
QTY REQD	QTY REQD	QTY REQD	QTY REQD	QTY REQD	QTY REQD	QTY REQD	QTY REQD	QTY REQD	PART OR IDENTIFYING NO	NOMENCLATURE OR DESCRIPTION	MATERIAL OR NOTE	SPECIFICATION	ZONE	ITEM NO
-82	-71	-65	-53	-5	-4	-3	-2	-1	← ASSY NO	LIST OF MATERIALS OR PARTS LIST				

CONT'D FROM SHEET #1



(56) DETAIL - SPRING - EJECTION AFT (13E)
MATL: .177 DIA SPRING STEEL WIRE PER QQ-W-470
SQUARENESS OF ENDS WHEN IN FREE
POSITION WITHIN 2°. DIRECTION OF
HELIX OPTIONAL. SPRING RATE 20 LBS/IN
SCALE $\frac{1}{1}$

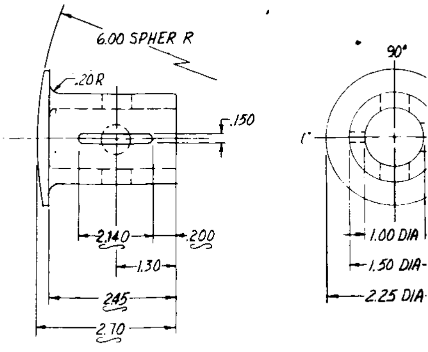
UNLESS OTHERWISE SPECIFIED

Avco research and advanced development division

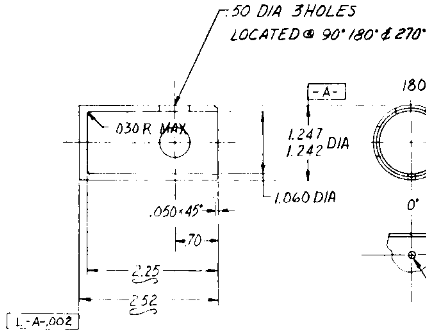
TITLE MARS PROBE & STERILIZATION CANISTER ASSY HUNTSVILLE

CODE IDENT NO	SIZE	DWG NO
04614	J	LA7671
SCALE	REL	SHEET SHT 2

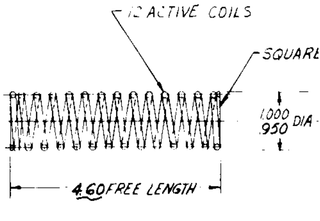
3



(-31) DETAIL - HOUSING - FWD SPRING
MATL 6061-T6 ALUM ALLOY
PER QQ-A-200/8 TEMPER T6
SCALE $\frac{1}{1}$

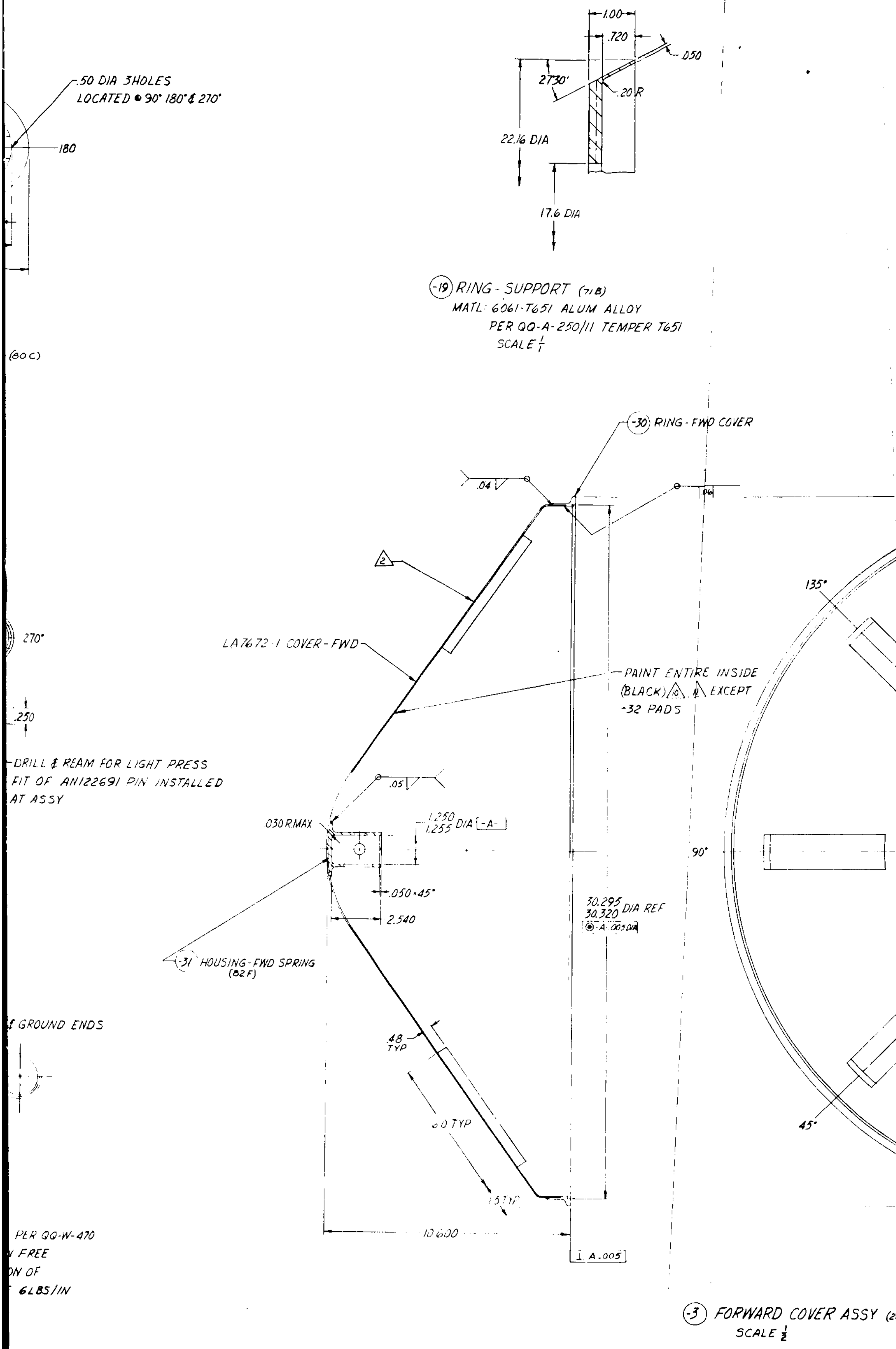


(-57) DETAIL - PISTON (2/C)
MATL: 6061-T6 ALUM ALLOY
PER QQ-A-200/8 TEMPER T6
SCALE $\frac{1}{1}$



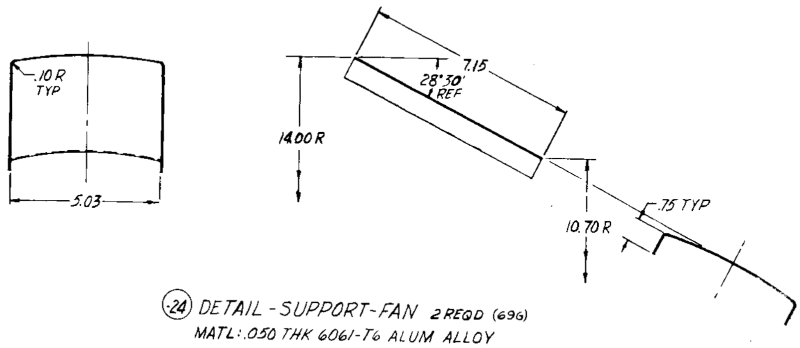
(-58) DETAIL - SPRING - FWD (2/E
MATL: .076 DIA SPRING STEEL W
SQUARENESS OF ENDS WHE
POSITION WITHIN 2° DIR
HELIX OPTIONAL SPRING
SCALE $\frac{1}{1}$

6-1

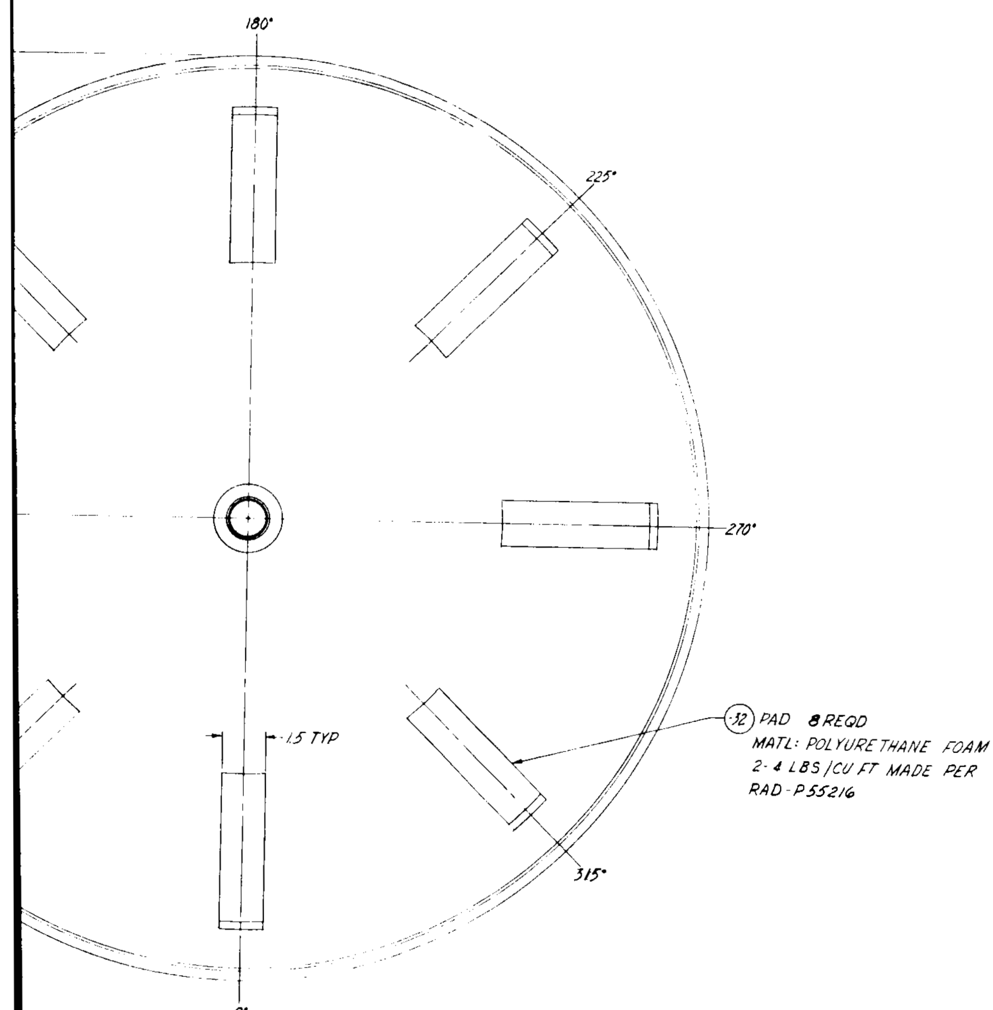


6 -

Figure 1 (Cont.)
(D)

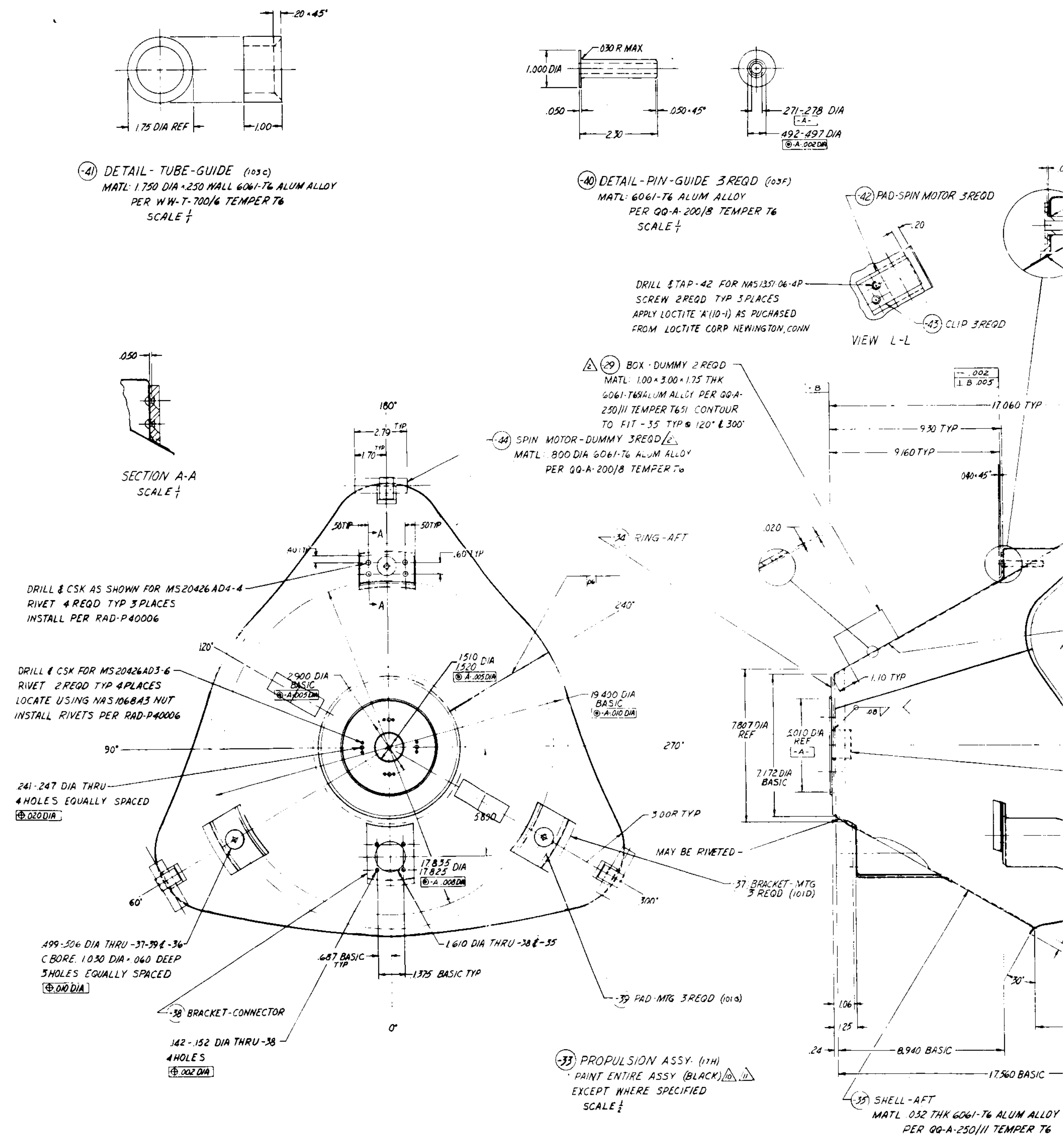


(-24) DETAIL - SUPPORT-FAN 2 REQD (696)
MATL: .050 THK 6061-T6 ALUM ALLOY
PER QQ-A-250/11 TEMPER T6
SCALE $\frac{1}{2}$



3

2



.20 × 45°
1.75 DIA REF
1.00
-41 DETAIL - TUBE-GUIDE (103C)
MATL: 1.750 DIA × .250 WALL 6061-T6 ALUM ALLOY
PER WW-T-700/6 TEMPER T6
SCALE 1/1
.030 R MAX
1.000 DIA
.050
.050 × 45°
2.30
.271-.278 DIA
-A-
.492-.497 DIA
-40 DETAIL - PIN-GUIDE 3 REQD (103F)
MATL: 6061-T6 ALUM ALLOY
PER QQ-A-200/8 TEMPER T6
SCALE 1/1
-42 PAD-SPIN MOTOR 3 REQD
.20
DRILL & TAP-42 FOR NAS1351-06-4P
SCREW 2 REQD TYP 3 PLACES
APPLY LOCTITE 'A' (10-1) AS PUCHASED
FROM LOCTITE CORP NEWINGTON, CONN
-43 CLIP 3 REQD
VIEW L-L
.050
SECTION A-A
SCALE 1/1
-29 BOX - DUMMY 2 REQD
MATL: 1.00 × 3.00 × 1.75 THK
6061-T651 ALUM ALLOY PER QQ-A-250/11 TEMPER T651 CONTOUR
TO FIT -35 TYP @ 120° & 300°
-44 SPIN MOTOR - DUMMY 3 REQD
MATL: .800 DIA 6061-T6 ALUM ALLOY
PER QQ-A-200/8 TEMPER T6
180°
2.79 TYP
1.70 TYP
.50 TYP
.60 TYP
.40 TYP
DRILL & CSK AS SHOWN FOR MS20426AD4-4
RIVET 4 REQD TYP 3 PLACES
INSTALL PER RAD-P40006
-34 RING - AFT
240°
120°
DRILL & CSK FOR MS20426AD3-6
RIVET 2 REQD TYP 4 PLACES
LOCATE USING NAS1068A3 NUT
INSTALL RIVETS PER RAD-P40006
2.900 DIA BASIC
1.510 DIA
1.520
19.400 DIA BASIC
90°
270°
.241-.247 DIA THRU
4 HOLES EQUALLY SPACED
.020 DIA
5.890
3.00 R TYP
MAY BE RIVETED
17.835 DIA
17.825
.008 DIA
-37 BRACKET - MTG 3 REQD (101D)
60°
300°
.499-.506 DIA THRU -37-39 & -36
C BORE 1.030 DIA × .060 DEEP
3 HOLES EQUALLY SPACED
.010 DIA
.687 BASIC TYP
1.375 BASIC TYP
1.610 DIA THRU -38 & -35
-38 BRACKET - CONNECTOR
-39 PAD - MTG 3 REQD (101G)
.142-.152 DIA THRU -38
4 HOLES
.002 DIA
0°
-33 PROPULSION ASSY (17H)
PAINT ENTIRE ASSY (BLACK)
EXCEPT WHERE SPECIFIED
SCALE 1/2
.002
B .005
17.060 TYP
9.30 TYP
9.160 TYP
.040 × 45°
.020
1.10 TYP
7.807 DIA REF
5.010 DIA REF
-A-
7.172 DIA BASIC
.08
1.06
1.25
.24
8.940 BASIC
17.560 BASIC
30°
-35 SHELL - AFT
MATL .032 THK 6061-T6 ALUM ALLOY
PER QQ-A-250/11 TEMPER T6

7 (7)

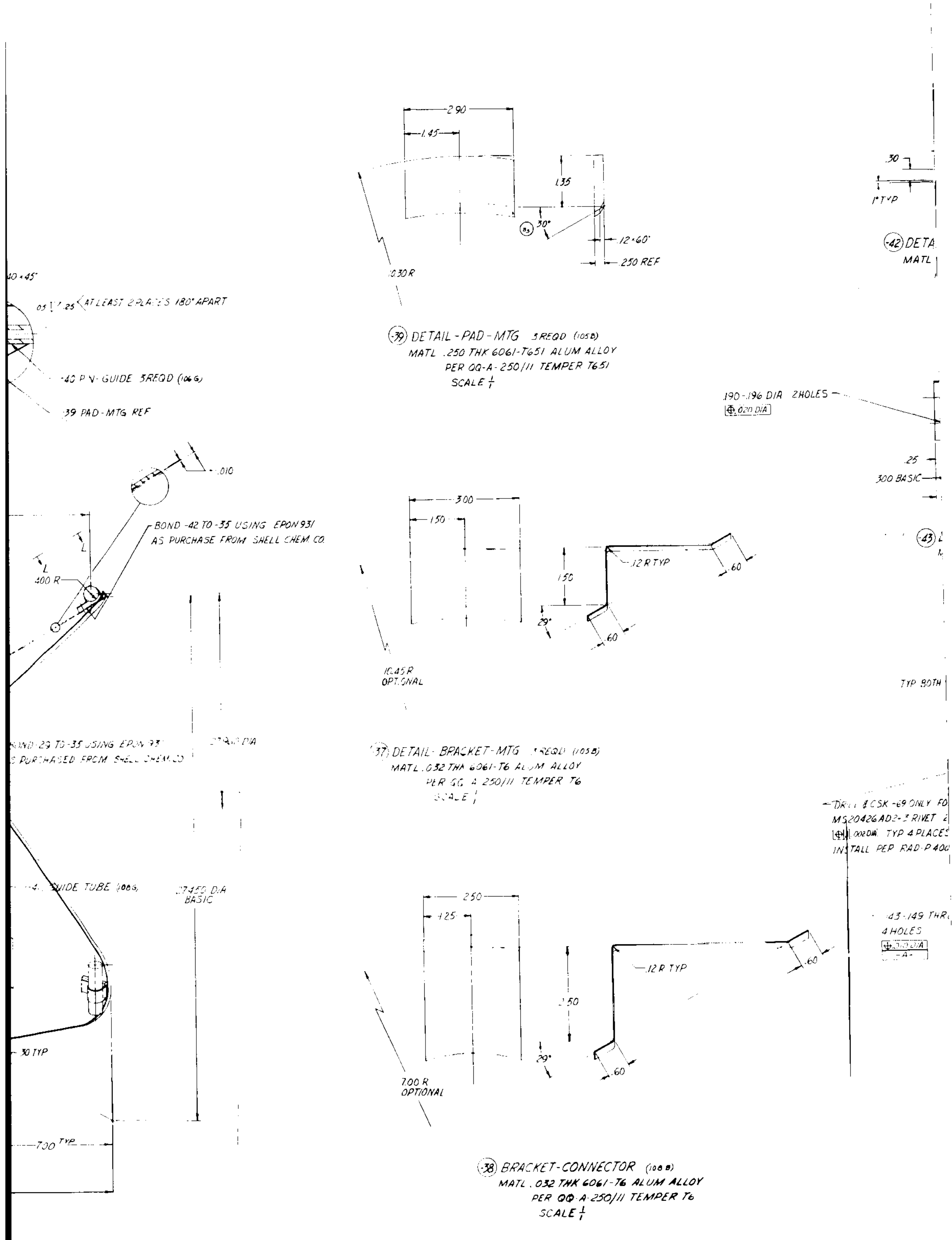
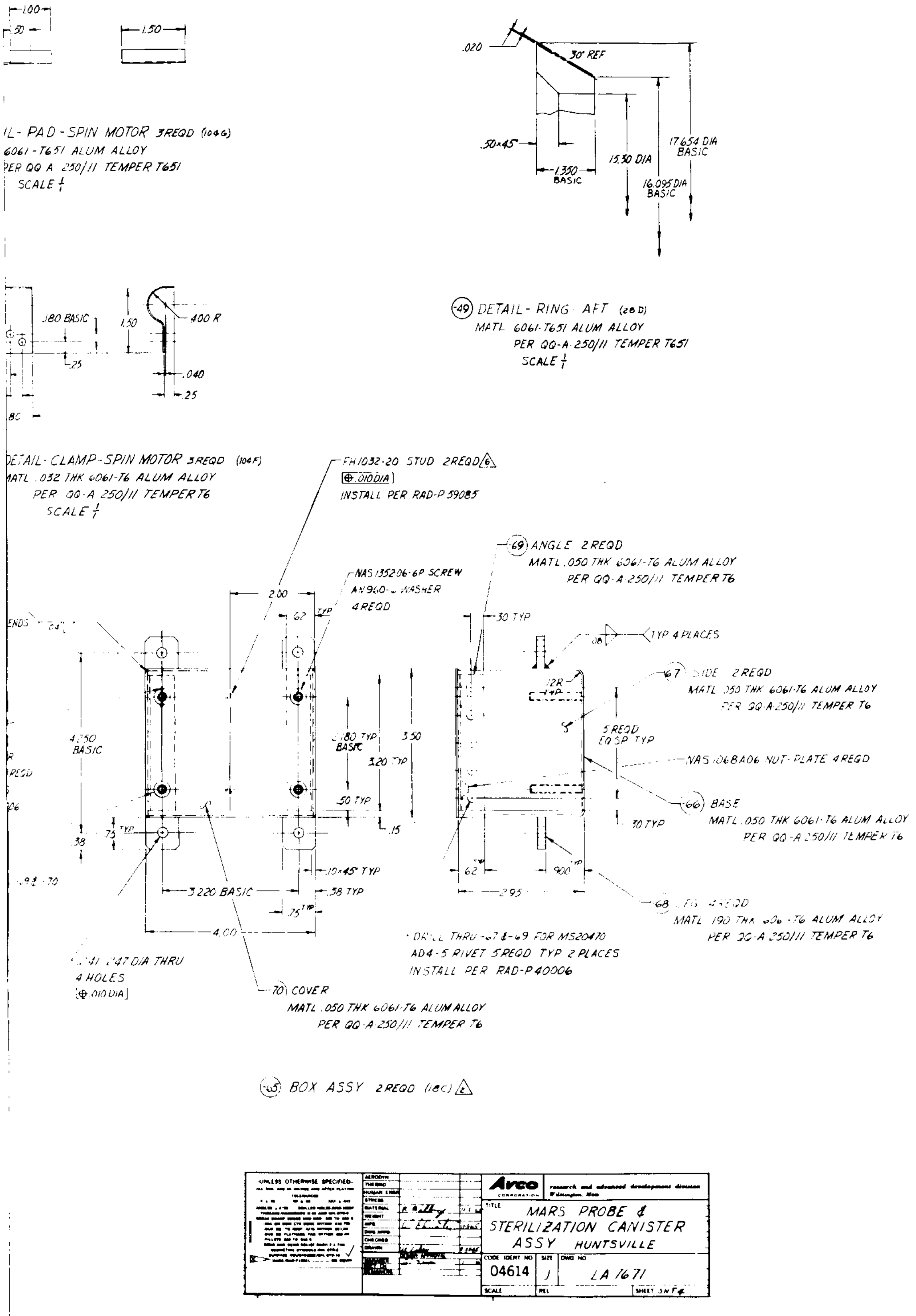


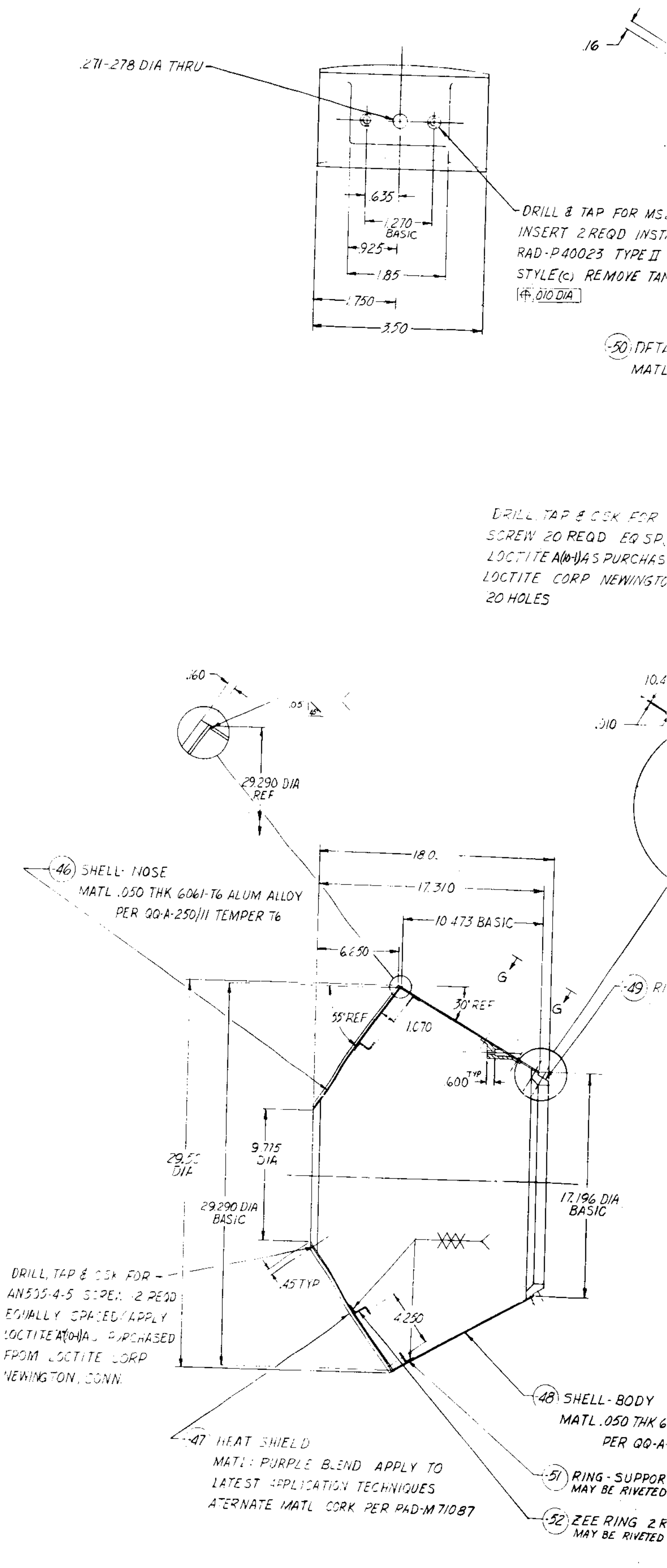
Figure 1 (Cont)
(E)

7 (2)



IL - PAD - SPIN MOTOR 3 REQD (104G)
6061-T651 ALUM ALLOY
PER QQ A 250/11 TEMPER T651
SCALE 1/1
.020
30° REF
.50×45°
1.350 BASIC
15.30 DIA
16.095 DIA BASIC
17.654 DIA BASIC
(-49) DETAIL - RING AFT (28 D)
MATL 6061-T651 ALUM ALLOY
PER QQ-A-250/11 TEMPER T651
SCALE 1/1
.180 BASIC
1.50
.400 R
.25
.040
.25
DETAIL - CLAMP - SPIN MOTOR 3 REQD (104F)
MATL .032 THK 6061-T6 ALUM ALLOY
PER QQ-A 250/11 TEMPER T6
SCALE 1/1
FH1032-20 STUD 2 REQD
⊕ .010 DIA
INSTALL PER RAD-P 59085
(-69) ANGLE 2 REQD
MATL .050 THK 6061-T6 ALUM ALLOY
PER QQ-A-250/11 TEMPER T6
NAS 1352-06-6P SCREW
AN960- WASHER
4 REQD
2.00
.62 TYP
.30 TYP
.08
TYP 4 PLACES
(-67) SIDE 2 REQD
MATL .050 THK 6061-T6 ALUM ALLOY
PER QQ-A-250/11 TEMPER T6
4.250 BASIC
.180 TYP BASIC
3.50
3.20 TYP
5 REQD EQ SP TYP
NAS 1068A06 NUT-PLATE 4 REQD
.50 TYP
.15
.75 TYP
.38
(-66) BASE
MATL .050 THK 6061-T6 ALUM ALLOY
PER QQ-A-250/11 TEMPER T6
.30 TYP
.10×45° TYP
.62 TYP
.900 TYP
3.220 BASIC
.58 TYP
.75 TYP
2.95
(-68) LEG 4 REQD
MATL .190 THK 6061-T6 ALUM ALLOY
PER QQ-A-250/11 TEMPER T6
4.00
DRILL THRU -67 & -69 FOR MS20470
AD4-5 RIVET 5 REQD TYP 2 PLACES
INSTALL PER RAD-P 40006
.241 .247 DIA THRU
4 HOLES
⊕ .010 DIA
(-70) COVER
MATL .050 THK 6061-T6 ALUM ALLOY
PER QQ-A-250/11 TEMPER T6
(-65) BOX ASSY 2 REQD (18C)
UNLESS OTHERWISE SPECIFIED
Avco CORPORATION
research and advanced development division
TITLE
MARS PROBE & STERILIZATION CANISTER ASSY HUNTSVILLE
CODE IDENT NO 04614
SIZE J
DWG NO LA 7671
SCALE
REL
SHEET 3 OF 4

3



SECTION F-F

8 (-7)

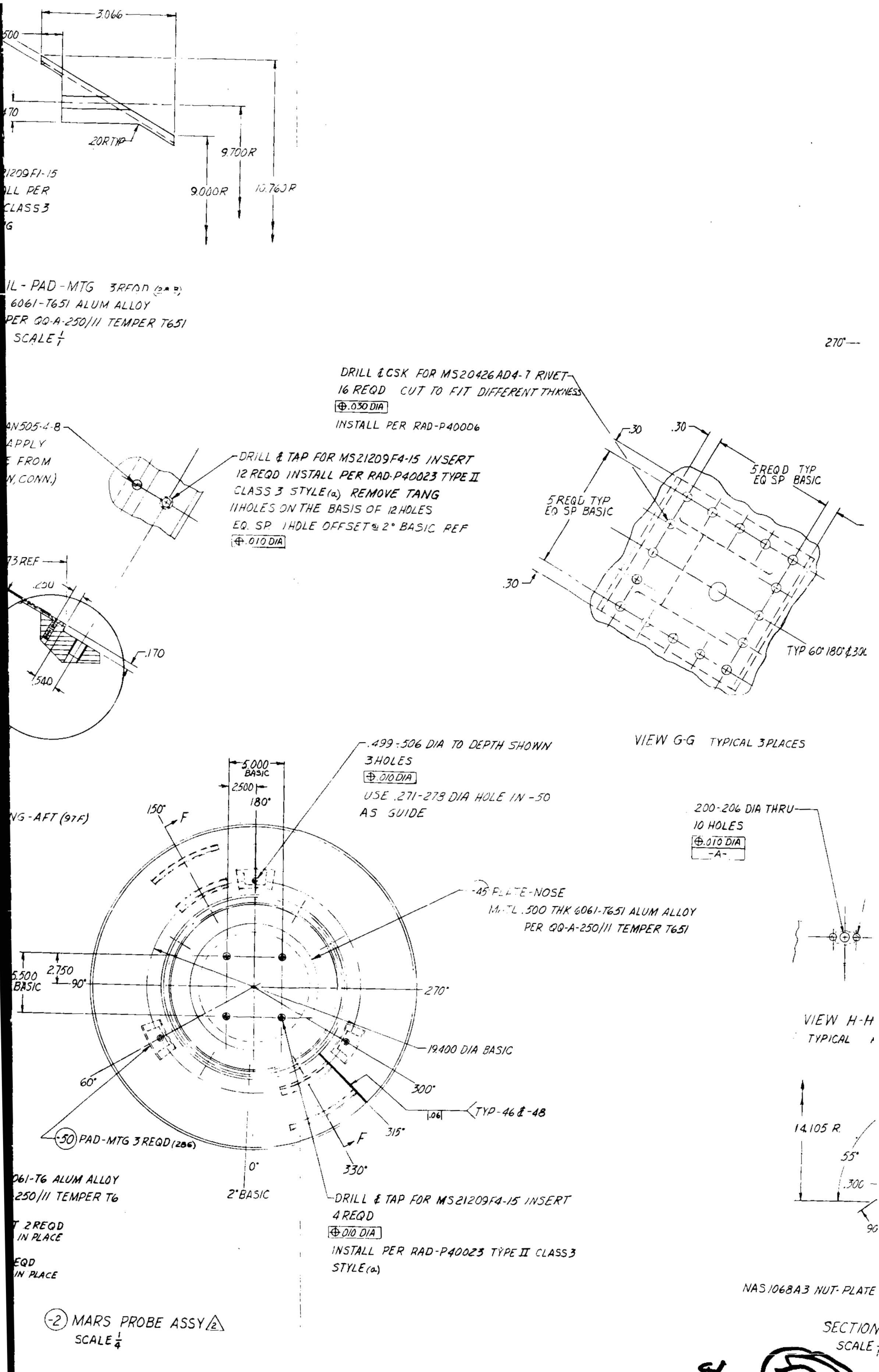
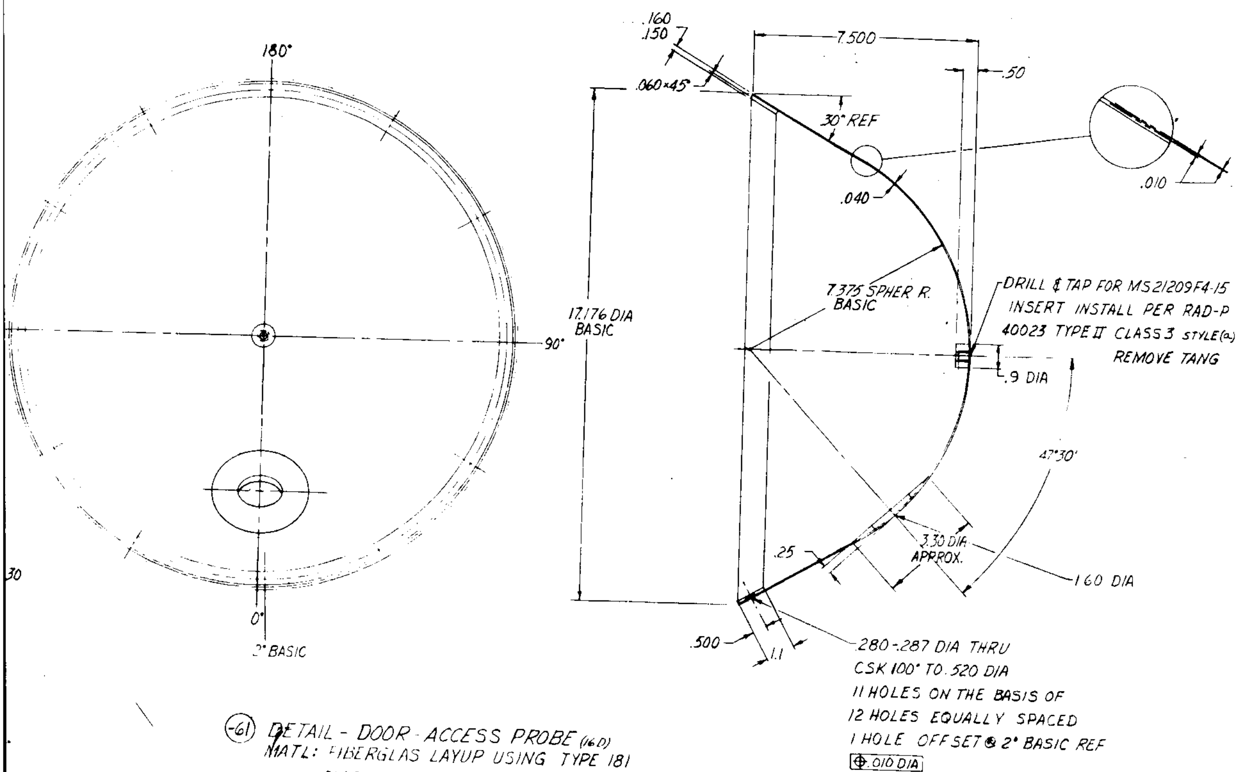


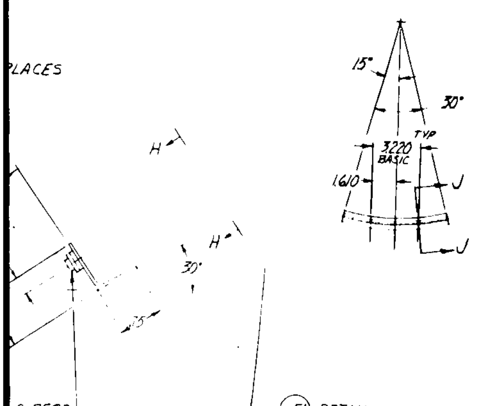
Figure 1 (Cont.)
(F)

8 5



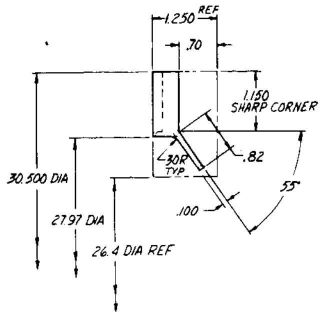
(61) DETAIL - DOOR - ACCESS PROBE (16D)
MATL: FIBERGLAS LAYUP USING TYPE 181
GLASS CLOTH PER MIL-F-9084 AND
EPOXY RESIN EPON 828 (SHELL CHEM. CO)
OR EQUIV. PER MIL-R-9300 (EM 77 TOOLING
CLOTH (EXETER MFG CO. EXETER, N.H. OR EQUIV.
MAY BE USED FOR UNDERNEATH LAYERS ON
SECTIONS OVER .040 THICKNESS)

- DRILL & CSK FOR MS20426AD 3-4
RIVET 2 REQD TYP PLACES
A .002 DIA
INSTALL PER RAD-P40006

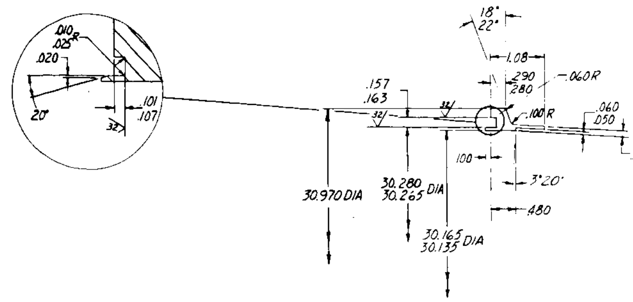


(51) DETAIL - RING - SUPPORT 2 REQD (28A)
MATL .050 THK 6061-T6 ALUM ALLOY
PER QQ-A-250/11 TEMPER T6
SCALE 1/4

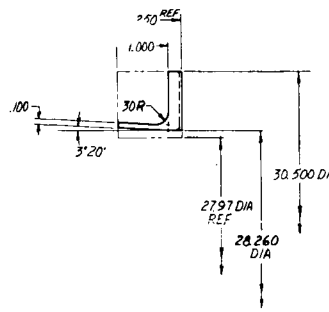
3



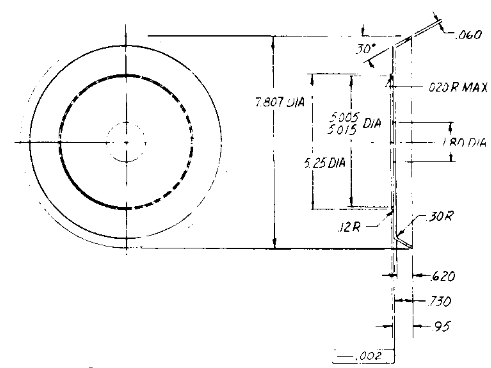
(-6) DETAIL - RING - REAR COVER (38F)
MATL: 1.250 THK 6061-T651 ALUM ALLOY
PER QQ-A-250/11 TEMPER T651
SCALE 1/1



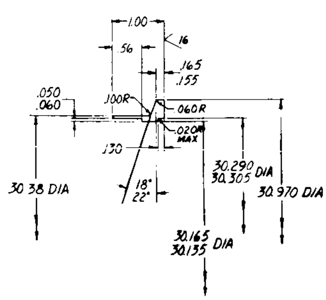
(-17) DETAIL - RING - FWD - CANISTER ASSY (70F)
MATL: 6061-T651 ALUM ALLOY
PER QQ-A-250/11 TEMPER T651
SCALE 1/1



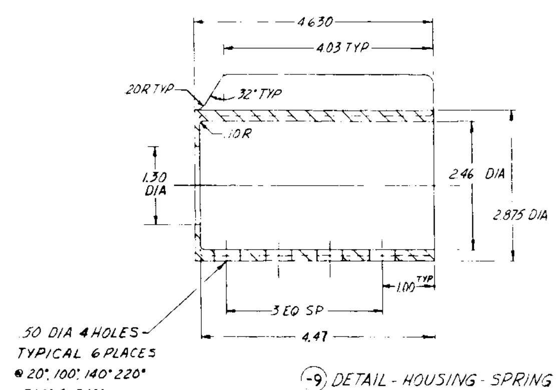
(-18) DETAIL - RING, AFT - CANISTER ASSY (68F)
MATL: 1.250 THK 6061-T651 ALUM ALLOY
PER QQ-A-250/11 TEMPER T651
SCALE 1/1



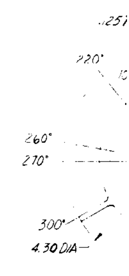
(-34) DETAIL - RING - AFT - PROPULSION ASSY (135E)
MATL: 1.000 THK 6061-T651 ALUM ALLOY
PER QQ-A-250/11 TEMPER T651
SCALE 1/2



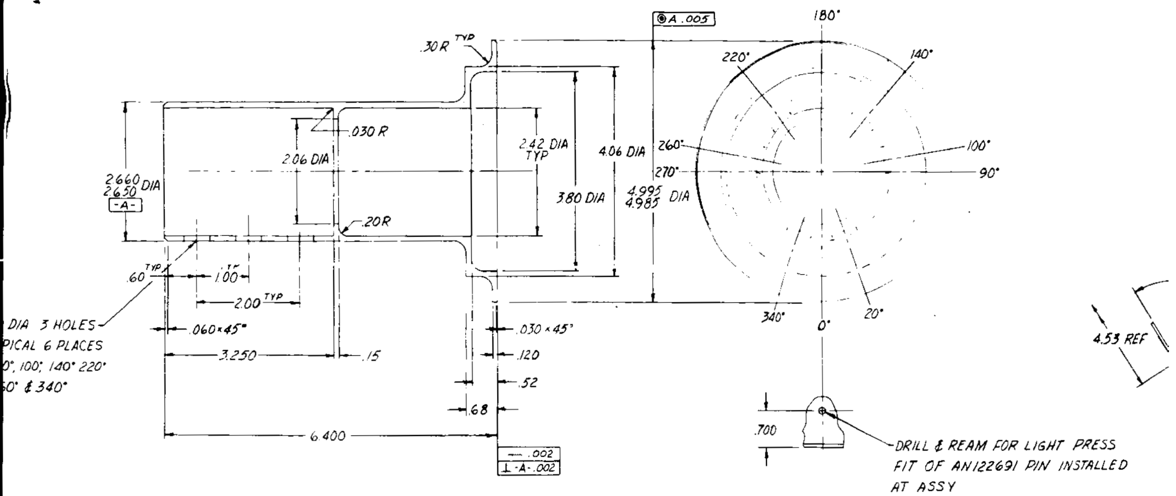
(-30) DETAIL - RING - FWD COVER (78F)
MATL: 6061-T651 ALUM ALLOY
PER QQ-A-250/11 TEMPER T651
SCALE 1/1



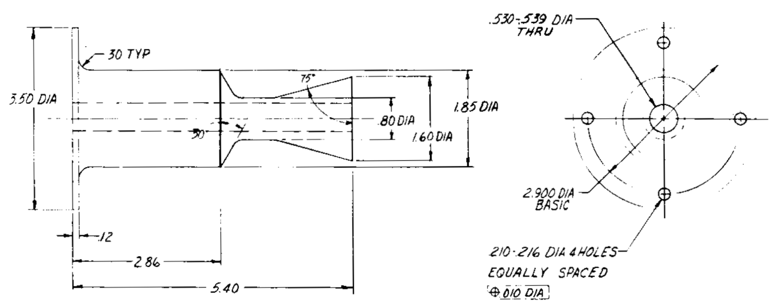
(-9) DETAIL - HOUSING - SPRING (37D)
MATL: 6061-T6 ALUM ALLOY
PER QQ-A-200/8 TEMPER T6
WELDING MAY BE USE AS
ALTERNATE METHOD OF
FABRICATION
SCALE 1/1



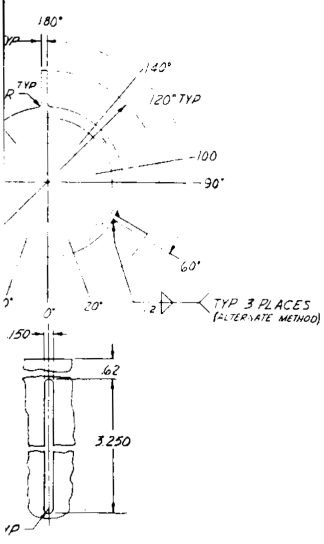
9 (1)

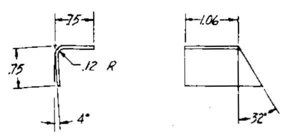


(-53) DETAIL - PISTON - SPRING HOUSING ASSY (13C)
MATL: 6061-T6 ALUM ALLOY
PER QQ-A-200/8 TEMPER T6
SCALE $\frac{1}{1}$



(-54) DETAIL - ROCKET MOTOR - DUMMY (13E)
MATL: C 1018 COLD DRAWN STEEL
CAD PLATE PER QQ-P-416 TYPE I CLASS 3
SCALE $\frac{1}{1}$



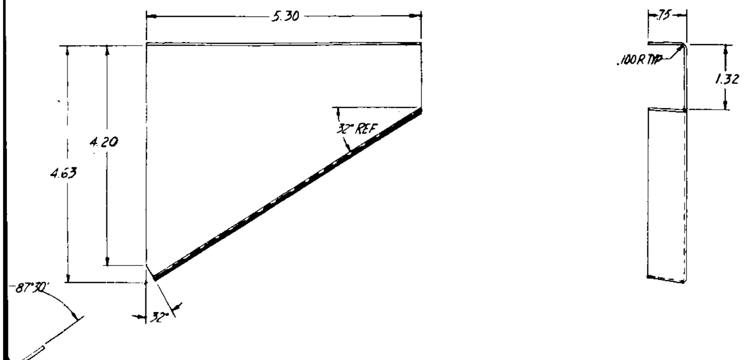


(-11) DETAIL - CLIP 3REQD (37E)
MATL: .050 THK 6061-T6 ALUM ALLOY
PER QQ-A-250/11 TEMPER T6
SCALE $\frac{1}{1}$

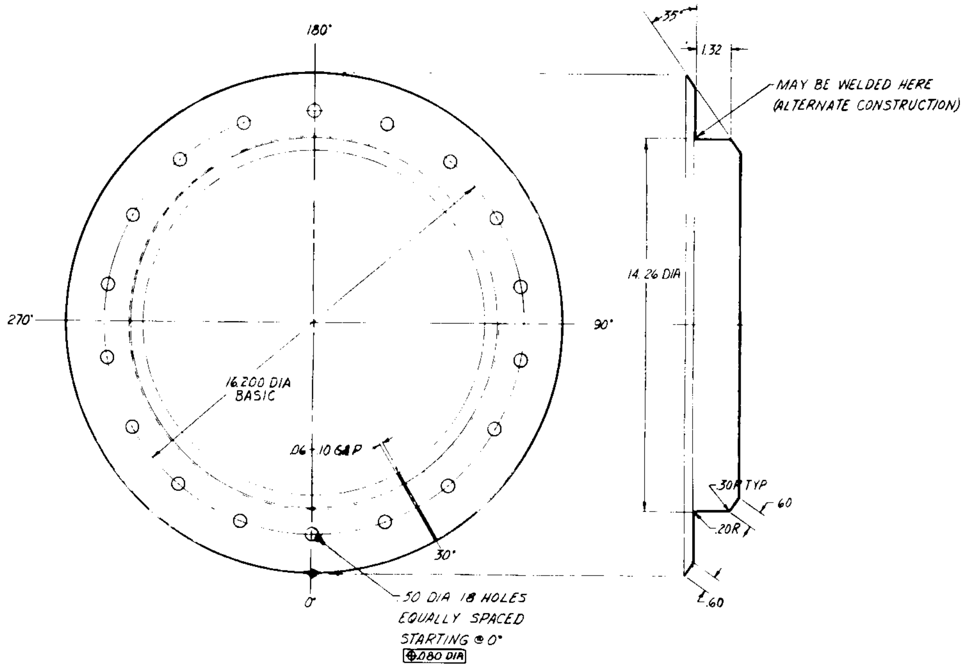
Figure 1 (Cont.)
(G)

9

2



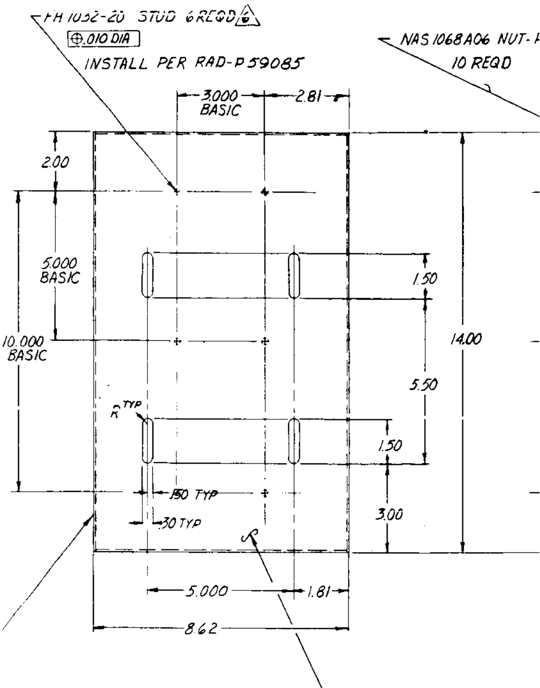
(-10) DETAIL - GUSSET 3 REQD (42 E)
MATL .050 THK 6061-T6 ALUM ALLOY
PER QQ-A-250/11 TEMPER T6
SCALE 1/1



(-7) DETAIL - RING - STIFFENER (37C)
MATL .050 THK 6061-T6 ALUM ALLOY
PER QQ-A-250/11 TEMPER T6
SCALE 1/2

Avco CORPORATION	research and advanced development division, Wilmington, Mass.
TITLE	MARS PROBE & STERILIZATION CANISTER ASSY HUNTSVILLE
CODE IDENT NO	04614
SIZE	J
DWG NO	LA 7671
SCALE	
REL	
SHEET	3 OF 4

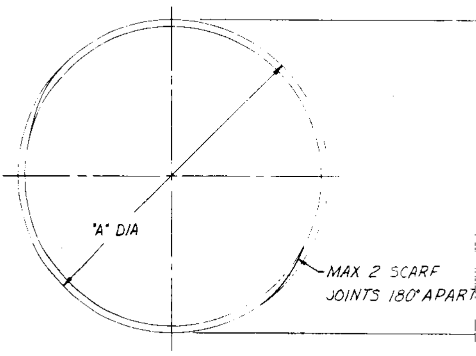
3



(-73) SIDE 2 REQD
MATL .050 THK 6061-T6 ALUM ALLOY
PER QQ-A-250/11 TEMPER T6

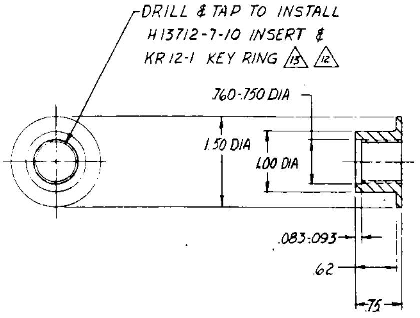
(-72) BASE
MATL .050 THK 6061-T6
PER QQ-A-250/11

(-71) MAS

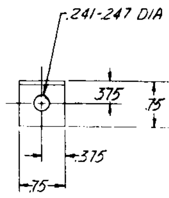


PART NO	"A" DIA	"B" DIM
-76	30.490 30.400	.135/.143
-77	29.100 29.000	.205/.215

(-76)(-77) DETAIL - GASKET "O" RING
MATL VITON AS PURCHASED FROM
PRECISION RUBBER PROD. CORP
DAYTON, OHIO COMPOUND #
OR EQUIV.

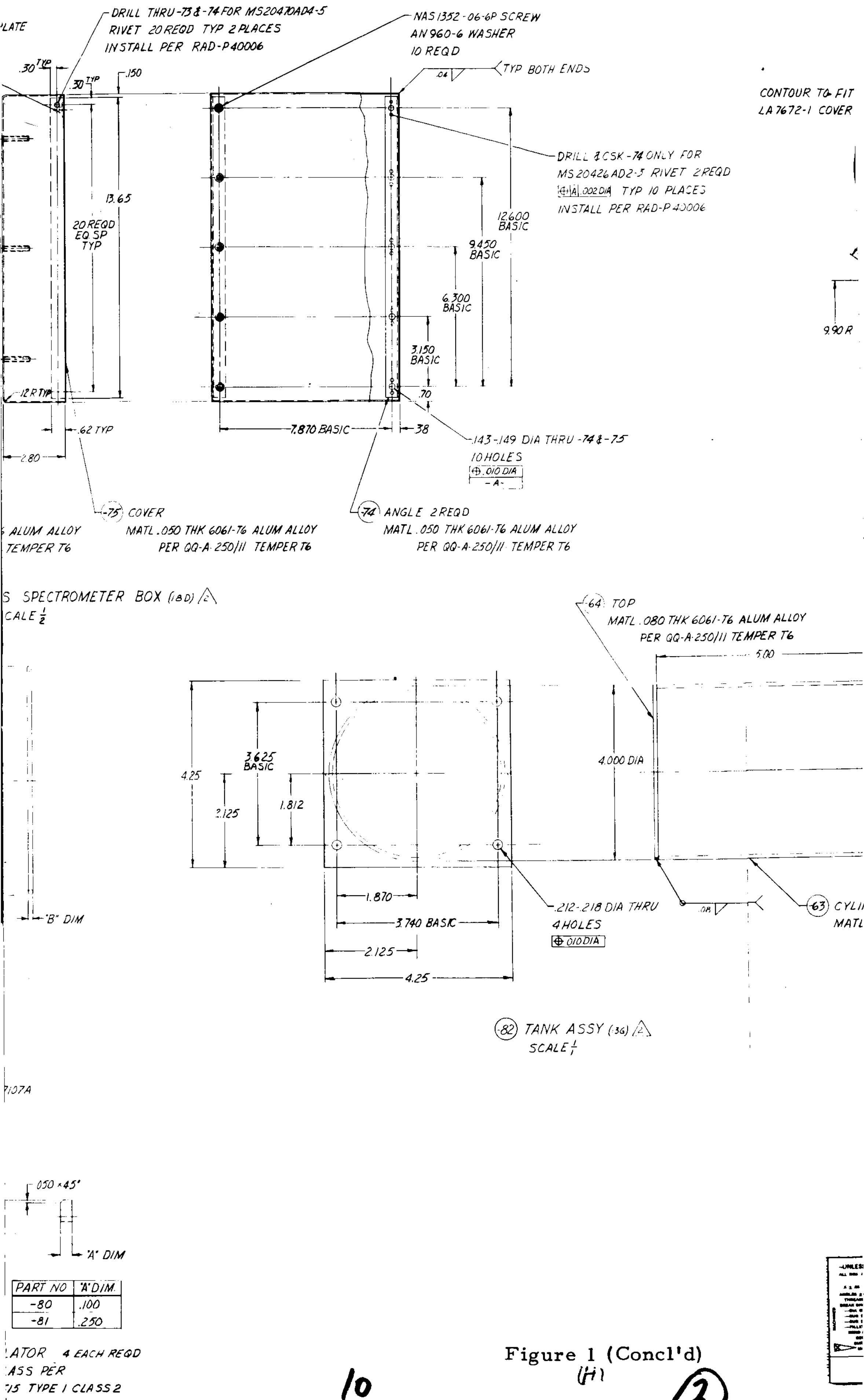


(-78) DETAIL - PLUG 2 REQD (378)
MATL 6061-T6 ALUM ALLOY
PER QQ-A-250/11 TEMPER T6
SCALE $\frac{1}{1}$



(-80)(-81) DETAIL - INSUL
MATL FIBER GL
MIL-P 25
SCALE $\frac{1}{1}$

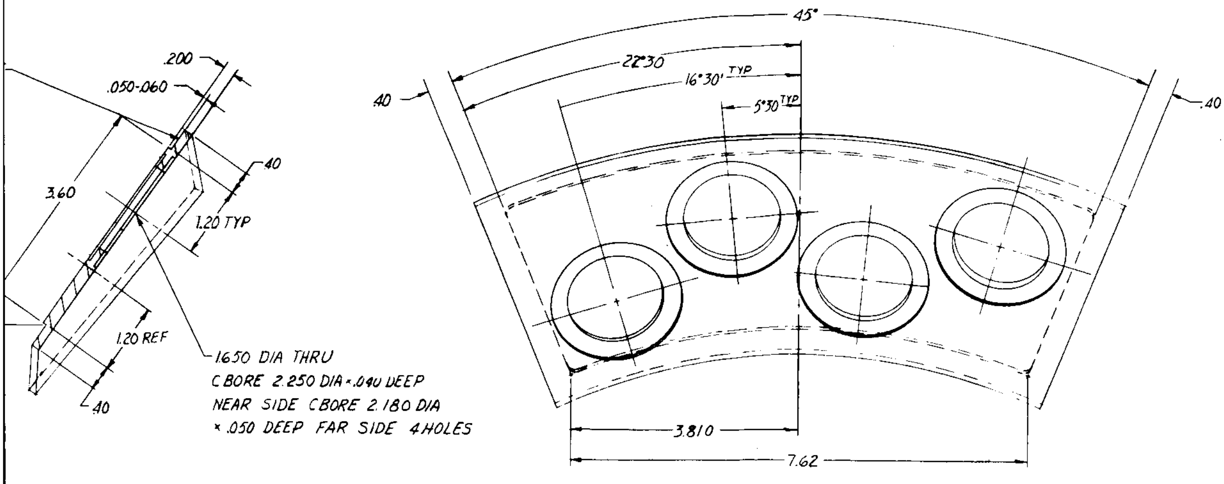
10 (1)



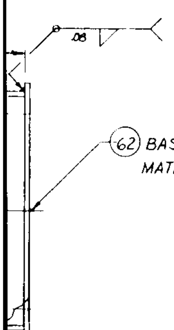
PART NO	'A' DIM.
-80	.100
-81	.250

Figure 1 (Concl'd)
(H)

2



(-79) DETAIL - PAD - CONNECTOR (40 B)
MATL 6061-T651 ALUM ALLOY
PER QQ-A-250/11 TEMPER T651
SCALE $\frac{1}{1}$



(62) BASE
MATL .080 THK 6061-T6 ALUM ALLOY
PER QQ-A-250/11 TEMPER T6

DER
.000 × .125 WALL 6061-T6 ALUM
LLOY PER QQ-A-200/8 TEMPER T6

Avco CORPORATION — research and advanced development division, Wilmington, Mass.

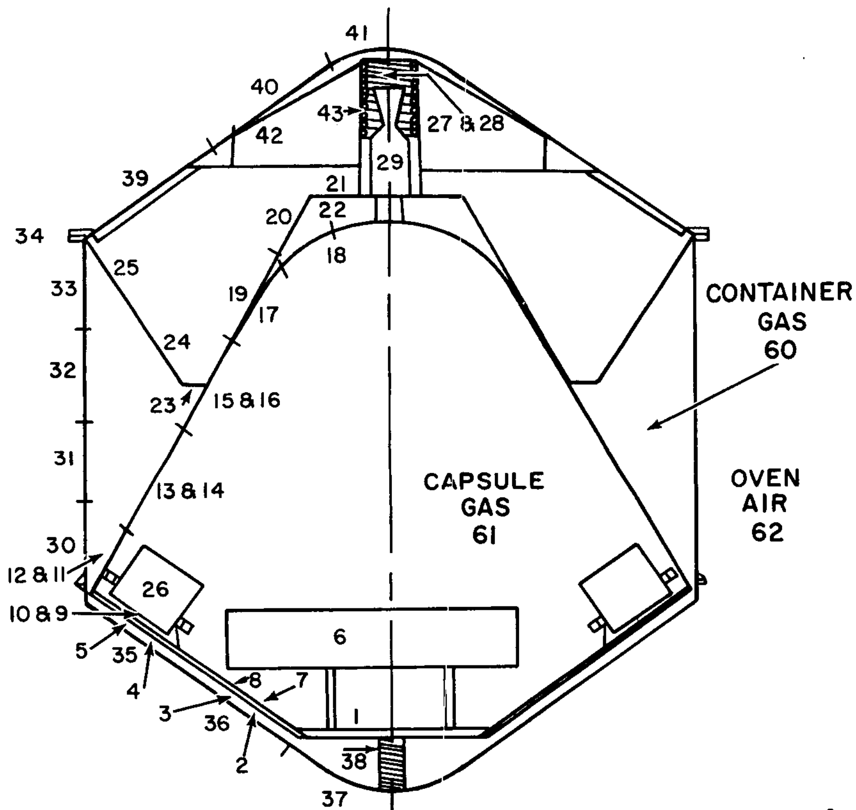
TITLE MARS PROBE & STERILIZATION CANISTER ASSY HUNTSVILLE

CODE IDENT NO.	SIZE	DWG NO.
04614	J	LA 7671

SCALE | REL | SHEET SHT 4

3

THERMAL MODEL



1	FORWARD END OF PROBE
2 & 3	HEAT SHIELD
4 & 5	HEAT SHIELD
6	INSTRUMENT IN CENTER
7 & 8	SUBSTRUCTURE FOR HEAT SHIELD
9 & 10	SUBSTRUCTURE FOR HEAT SHIELD
11 & 12	SIDE OF REAR BODY
13 & 14	SIDE OF REAR BODY
15 & 16	SIDE OF REAR BODY
17	LOWER PART OF R.F. WINDOW
18	UPPER PART OF R.F. WINDOW
19	LOWER PART OF PROPULSION ASSEMBLY
20	UPPER PART OF PROPULSION ASSEMBLY
21	FLAT PART OF PROPULSION ASSEMBLY
22	BATTERY OR SEQUENCER
23	PROBE MOUNTING RING
24	SIDE OF CONICAL SUPPORT
25	SIDE OF CONICAL SUPPORT
26	INSTRUMENT PACKAGE IN INTERIOR
27 & 28	SPRING ASSEMBLY
29	ROCKET MOTOR
30, 31, 32, 33	CYLINDRICAL SIDE OF STERILIZATION CONTAINER
34	MOUNTING FLANGE
35, 36, 37	CONTAINER LID
38	SPRING ASSEMBLY
39, 40, 41	AFT CLOSURE
42	SIDE PLATE FOR SPRING HOLDER
43	SPRING HOUSING
60	GAS BETWEEN PROBE AND CONTAINER
61	GAS INSIDE PROBE
62	OVEN AIR OUTSIDE CONTAINER

CONTAINER EXTERNAL HEAT TRANSFER COEFFICIENT 2 BTU/HR-FT^2-°F

SURFACE EMISSIVITIES

EXTERIOR CONTAINER ———— $\epsilon = 0.1$

INTERIOR CONTAINER ———— $\epsilon = 0.9$

EXTERIOR PROBE ———— $\epsilon = 0.1$

INTERIOR PROBE ———— $\epsilon = 0.1$

INSTRUMENTATION PACKAGE — LOW

Figure 2 THERMAL ANALYTICAL MODEL

76-0008P

2. THERMAL ANALYSIS

2.1 GENERAL DISCUSSION

The analytical approach to the thermal analysis is thoroughly discussed in the first quarterly progress report (RAD-SR-65-264, dated 15 October 1965). This analytical procedure was used to determine the thermal behavior of the final design configuration of the sterilization container and dummy probe assembly. The mathematical model of the system is shown in figure 2. This investigation was more detailed than that carried out during the preliminary design phase. It included the effects of the ejection spring areas, the fiberglass R.F. window, and the propulsion system on the assembly.

In predicting the behavior of the final design, a heat cycle with oven rise and cool-down times between room temperature to 145°C for 1 hour was used. The analysis includes heating inputs of 10 watts per pound of component to remote components of the probe.

The measurement of emissivity on actual hardware surfaces, between 0.1 and 0.14, is in close agreement with values used in the analysis. Other surfaces that require a high emissivity will be painted.

2.2 THERMAL PERFORMANCE PREDICTION

The analysis predicting performance includes the thermal response effect of nitrogen and helium inside the container under both free and forced convection conditions.

2.2.1 Heating Phase

Under free convection with nitrogen inside the internal heat transfer coefficient is 0.9 Btu/hr-ft^2°F. The response of the more significant components are shown in figure 3. The slowest response component (item 22) requires 6.3 hours to reach soak temperature. Item 26, a component which contains a heating pad, did not reach soak temperature in the time period investigated because the analysis assumed the heating pad cutoff too soon. This has a minor effect on overall system heat balance and time to achieve soak temperature.

A condition in which nitrogen was used with internal forced convection was next investigated. The forced convection heat transfer coefficient in this case was 4.6 Btu/hr-ft^2°F. Component response for this

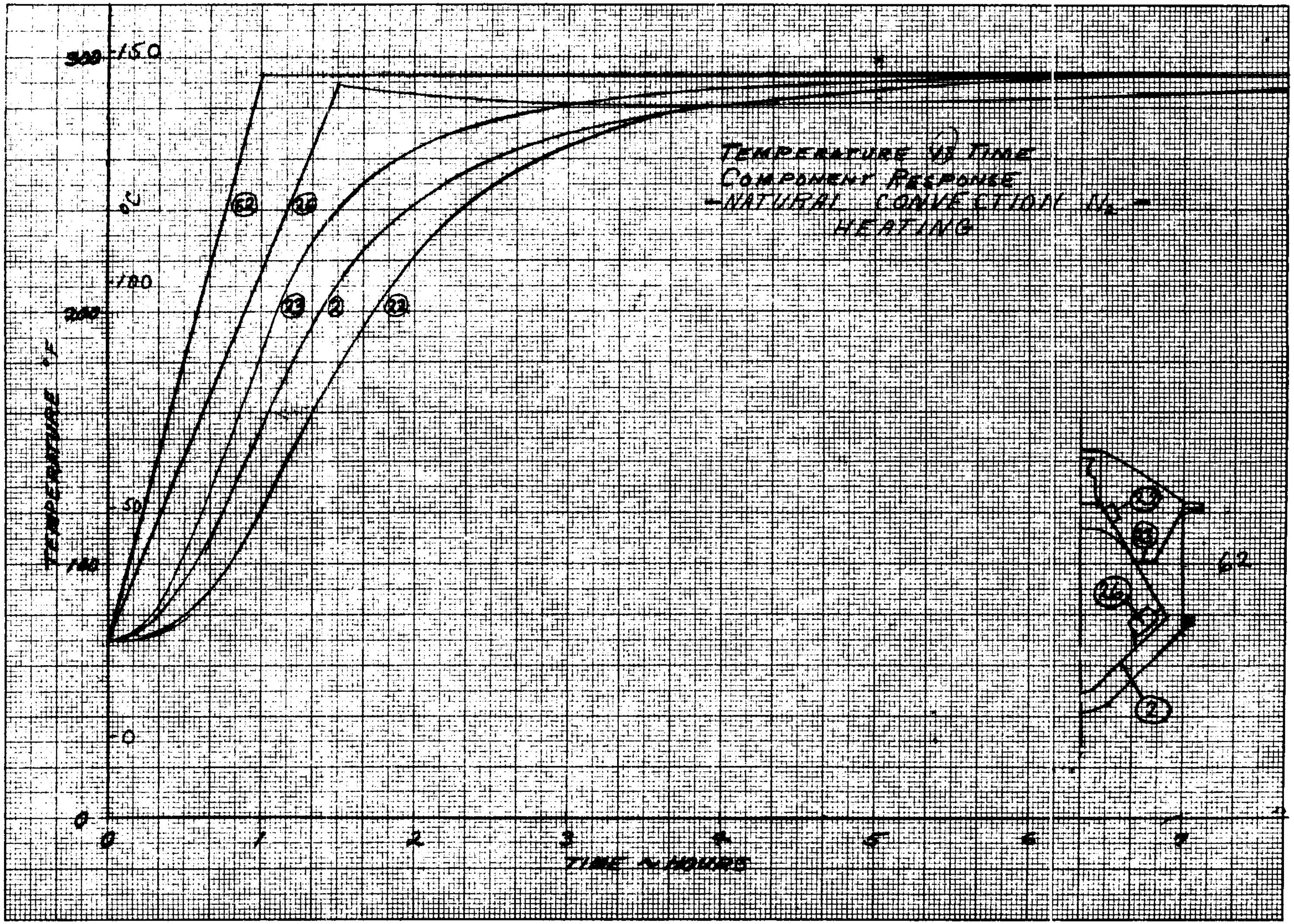


Figure 3 TEMPERATURE VERSUS TIME COMPONENT RESPONSE NATURAL CONVECTION N_2 HEATING

condition is shown in figure 4. Heat-up time of the slowest element is approximately 3 hours. Item 26 exceeded 145°C indicating in this instance that the heating pad was left on too long.

The third condition with helium in the sterilization container as the pressurizing gas, under free convection, results in a heat transfer coefficient of 1.85 Btu/hr-ft^2 °F. The component response is shown in figure 5. The slowest response element requires approximately 4.5 hours to reach soak temperature.

The fourth case, with helium under forced convection, has a heat transfer coefficient of 4.6 Btu/hr-ft^2 °F. Component response is shown in figure 6. Heat-up time of the slowest element is approximately 3 hours. Item 26 exceeded 145°C indicating in this instance that the heating pad was left on too long.

2.2.2 Cooling Phase

With nitrogen inside the sterilization container and free convection the thermal response of the system was calculated. The response of a few of the more significant components is shown in figure 7. Since item 26 is thermally insulated from the rest of the system, the response is quite slow. Figure 8 presents the thermal response of the system using nitrogen pressurizing gas under forced convection. Figure 9 shows the thermal response of the system using helium pressurizing gas under free convection. Figure 10 predicts the thermal response of the system using helium pressurizing gas under forced convection.

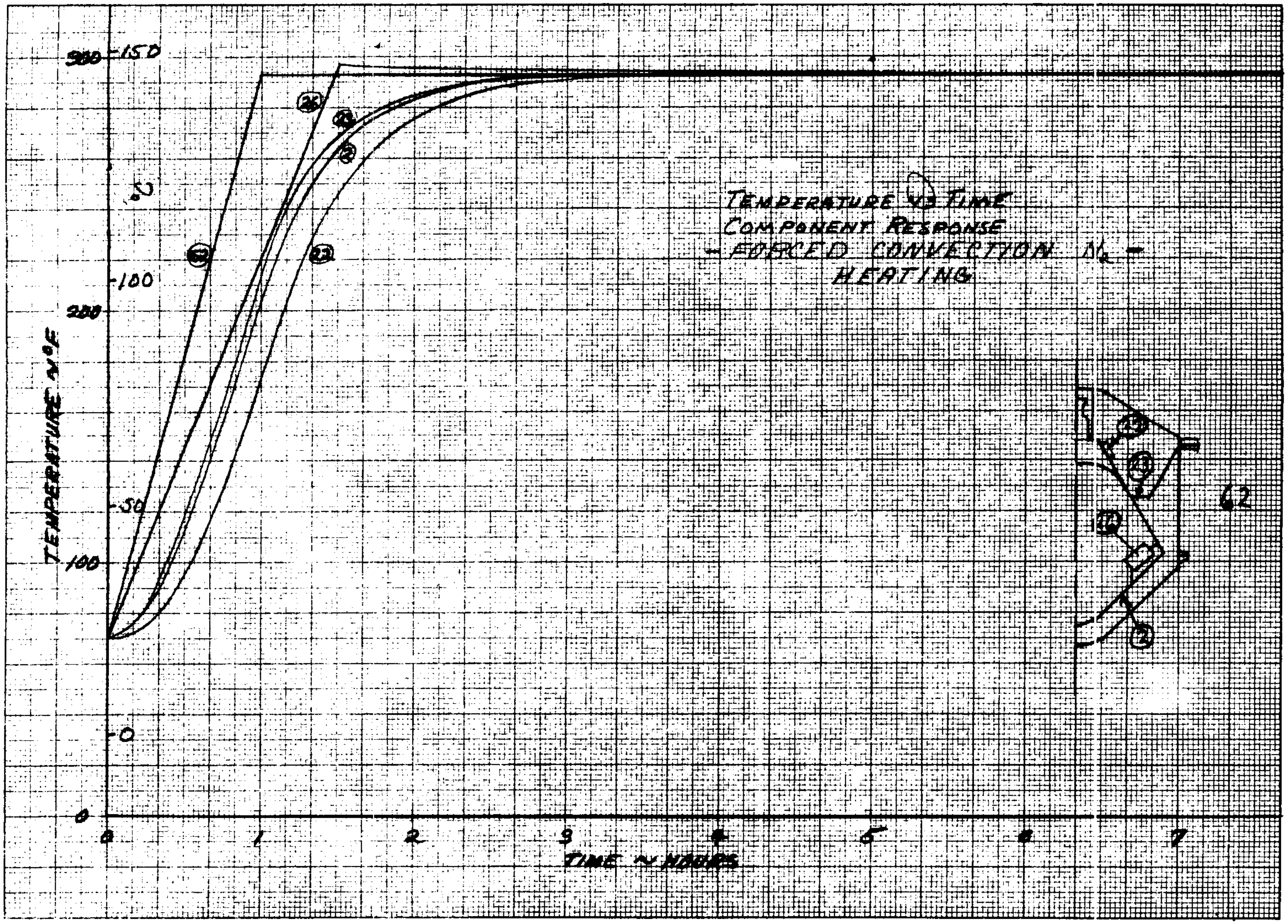


Figure 4 TEMPERATURE VERSUS TIME COMPONENT RESPONSE FORCED CONVECTION N_2 HEATING

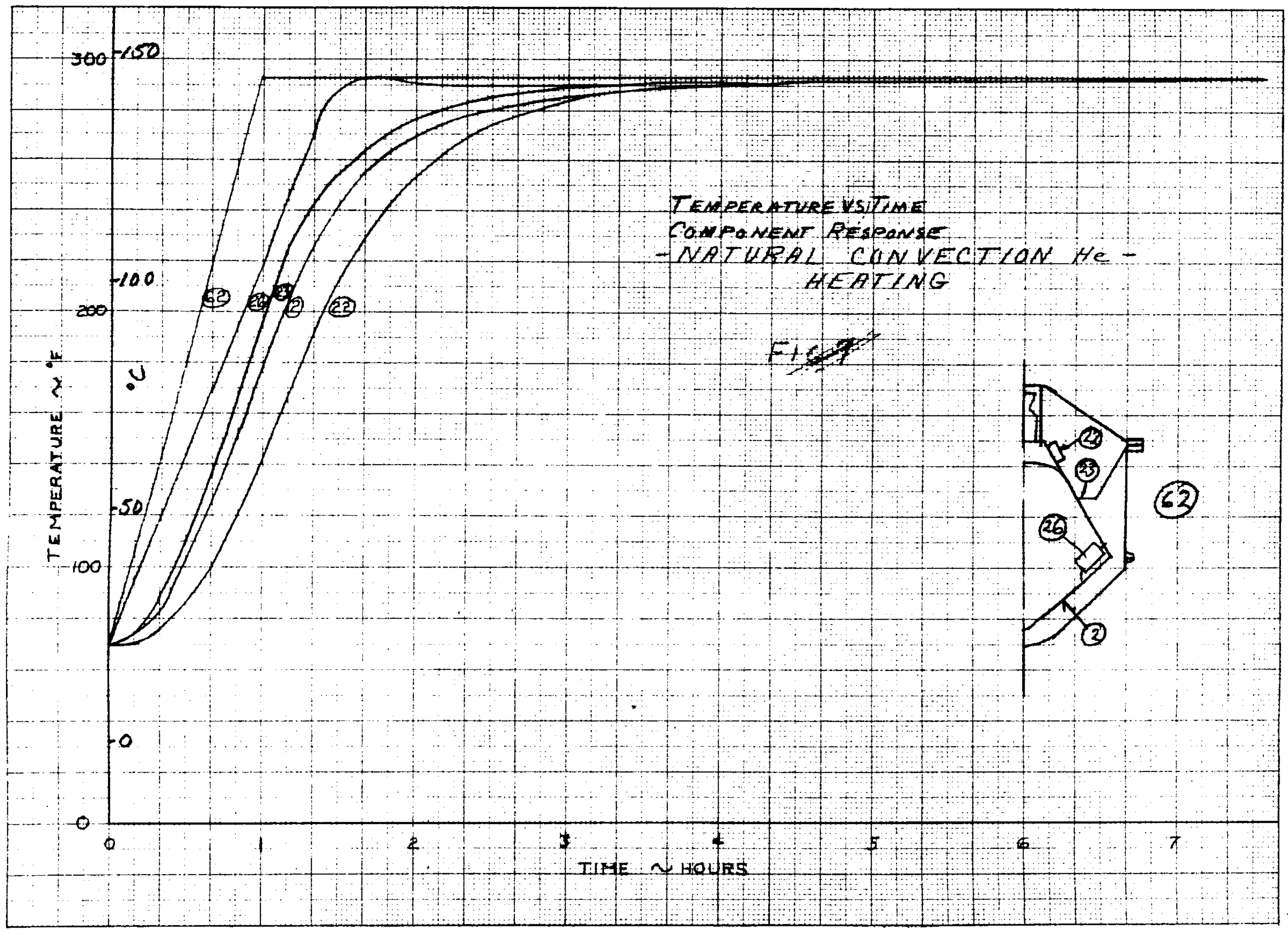


Figure 5 TEMPERATURE VERSUS TIME COMPONENT RESPONSE NATURAL CONVECTION H_e HEATING

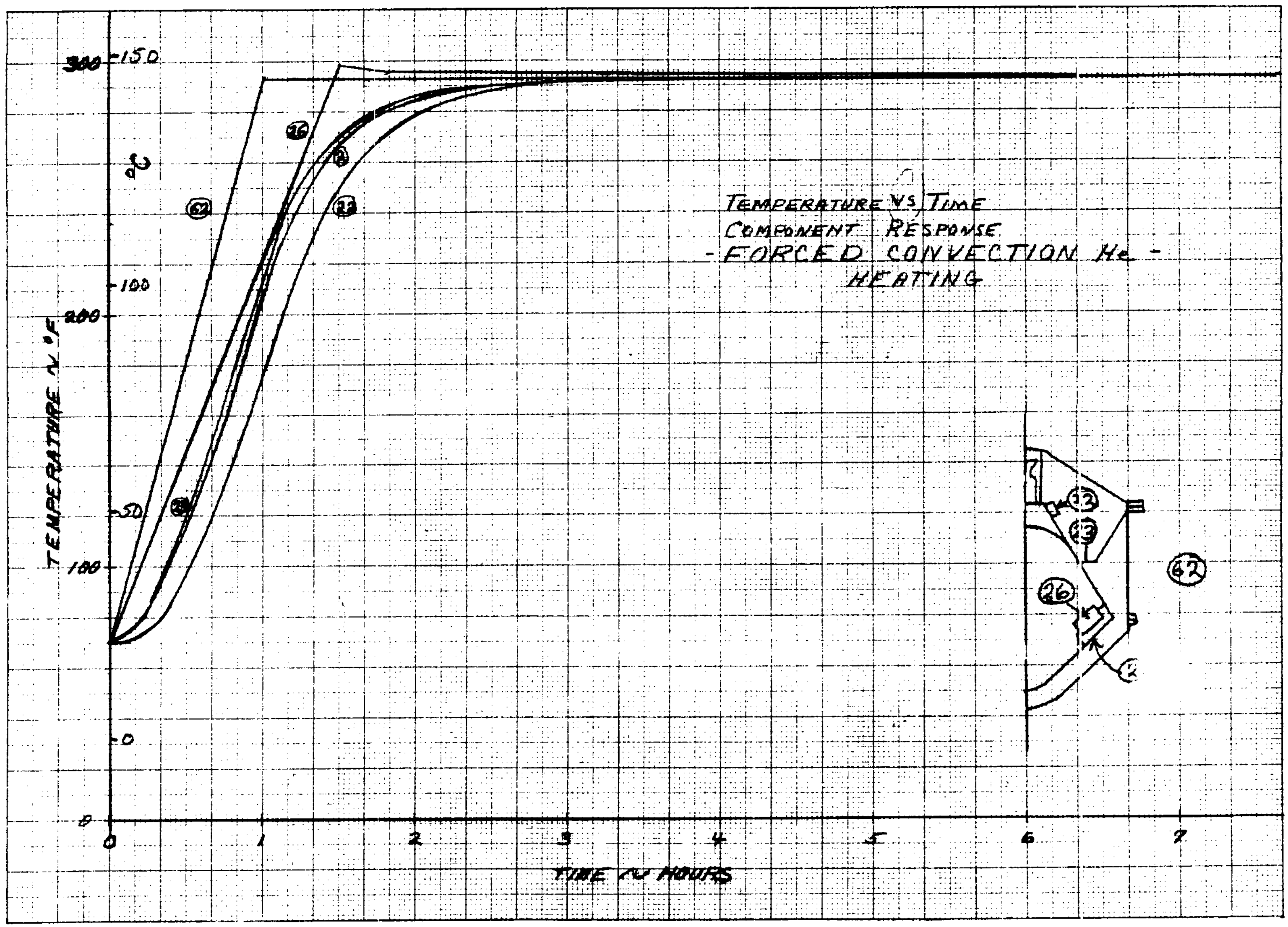


Figure 6 TEMPERATURE VERSUS TIME COMPONENT RESPONSE FORCED CONVECTION H_e HEATING

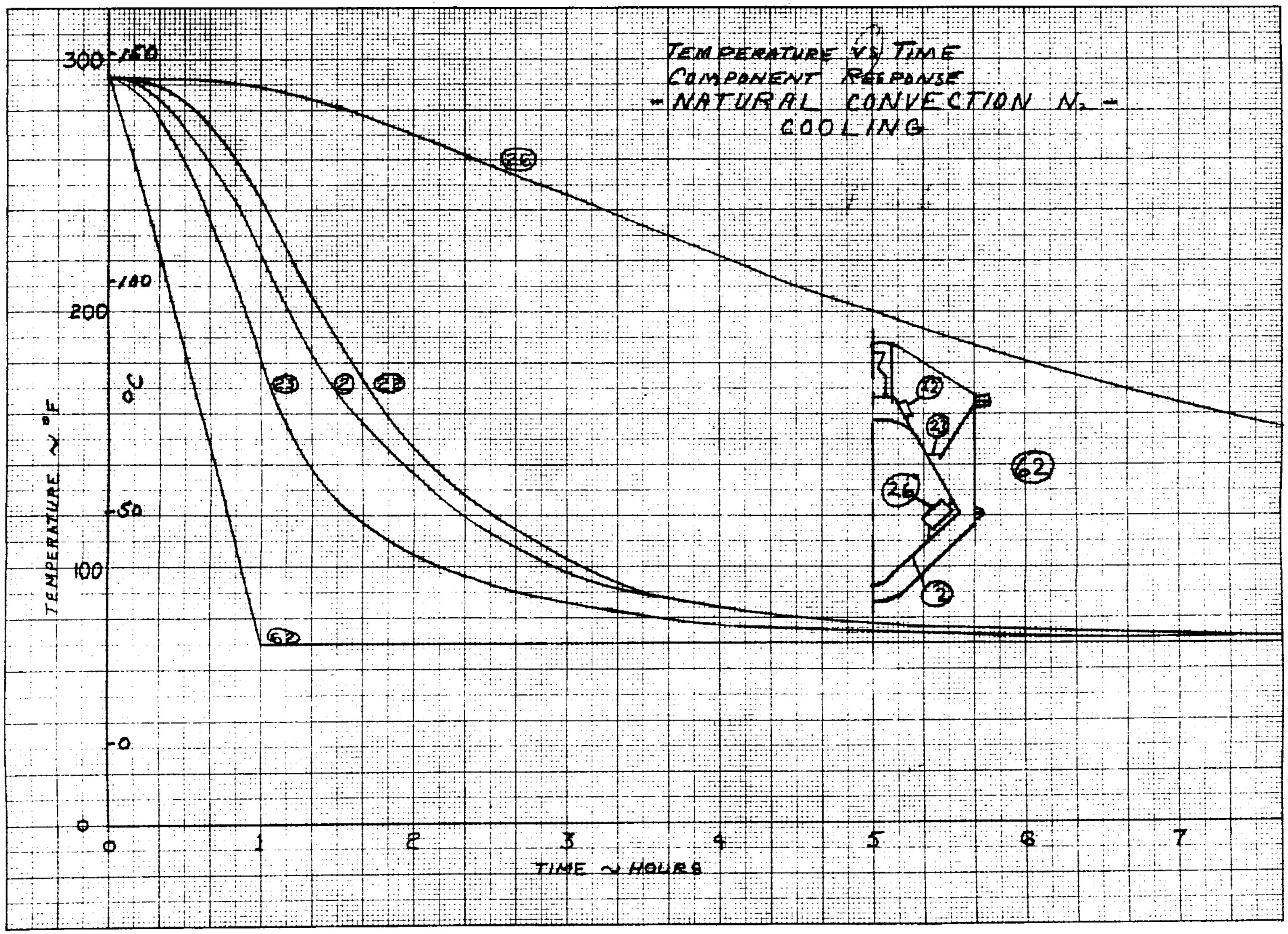


Figure 7 TEMPERAUTRE VERSUS TIME COMPONENT RESPONSE NATURAL CONVECTION N_2 COOLING

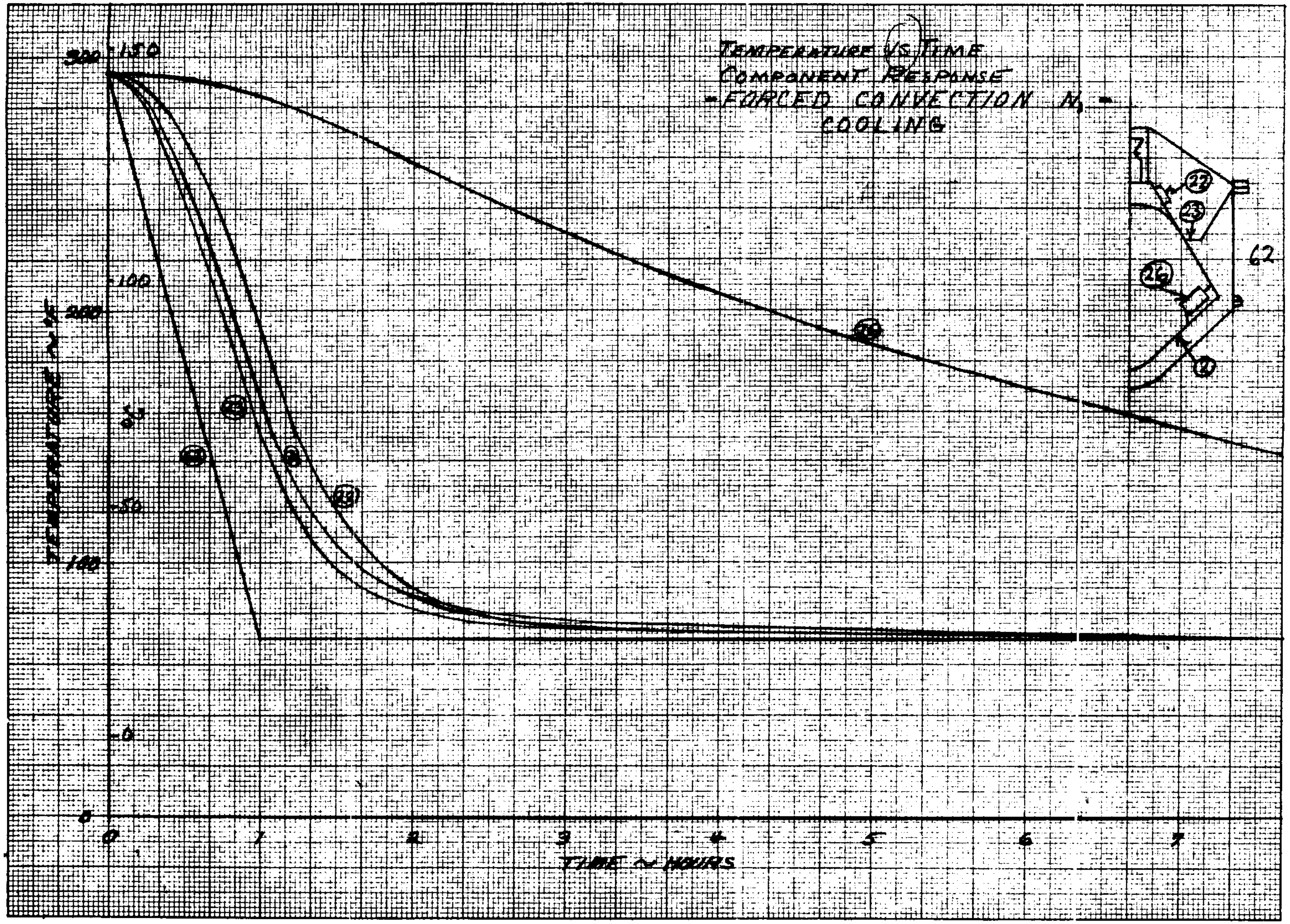


Figure 8 TEMPERATURE VERSUS TIME COMPONENT RESPONSE FORCED CONVECTION N_2 COOLING

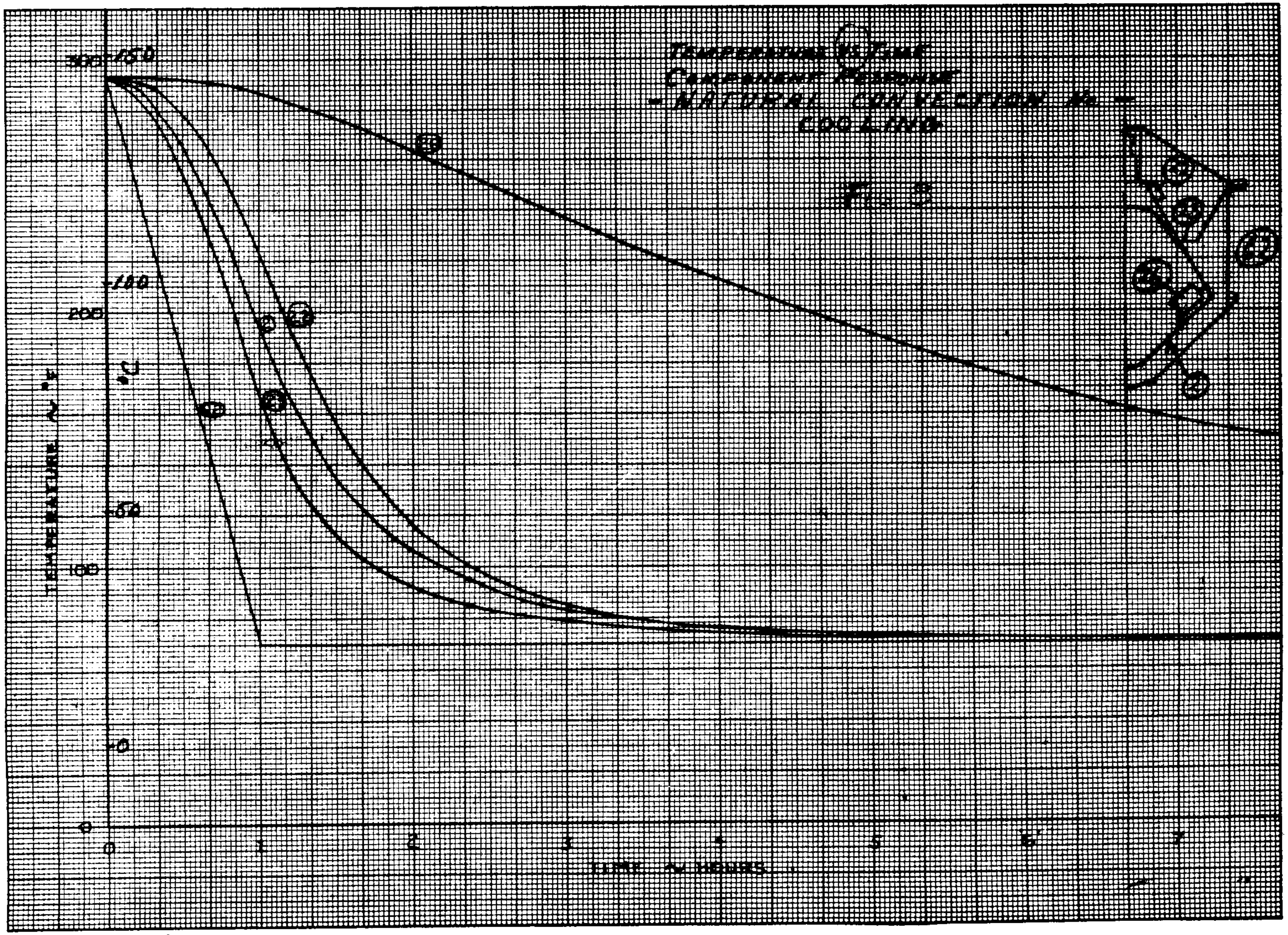


Figure 9 TEMPERAUTRE VERSUS TIME COMPONENT RESPONSE NATURAL CONVECTION H_e COOLING

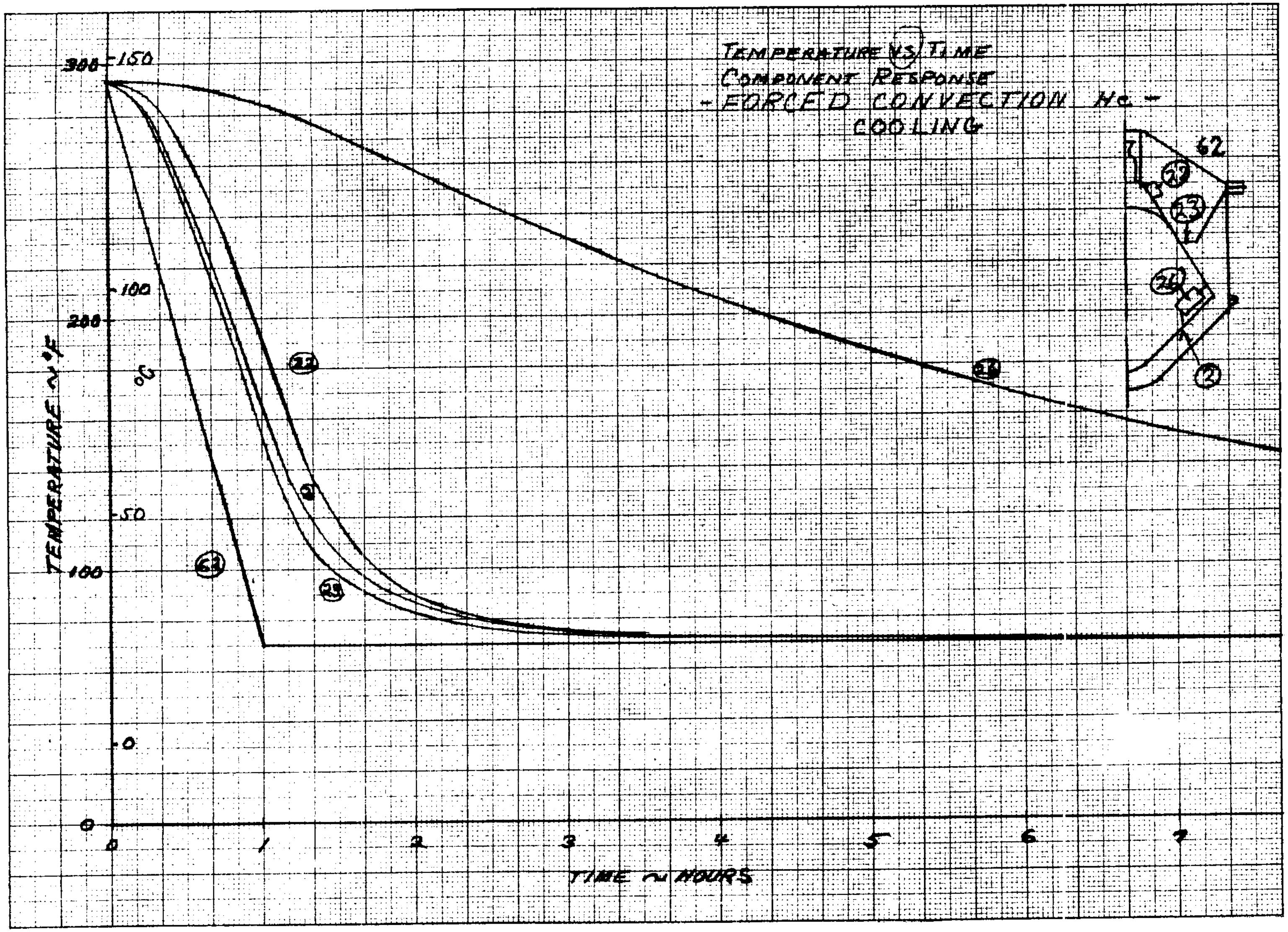


Figure 10 TEMPERATURE VERSUS TIME COMPONENT RESPONSE FORCED CONVECTION H_e COOLING

2.3 CONTROLLED OVEN OVERSHOOT

A controlled overshoot heat sterilization cycle analysis was made. Temperature levels in certain areas were allowed to exceed the specified sterilization temperature level [145°C (293°F)] in order to investigate the possibility of shortening the heat-up time of the slower responding items.

The oven temperature was increased from room temperature to 171°C in 1 hour, held at 171°C for 1 hour and then decreased to 145°C in 0.5 hour. Separate heat inputs were applied to the insulated components. The results of this temperature cycle are shown in figure 11. The slowest response item (item 22) stabilized in 4.5 hours with nitrogen pressurizing gas under free convection in the sterilization container. Under the same conditions, but with no oven overshoot, this item required 6.3 hours to reach the stabilization temperature. Only the exterior metallic surfaces and support structure exceeded the 145°C heat sterilization cycle. It is believed that this overshoot will have little effect on performance of the assembly. Although little cycle time reduction is realized when internal heaters are used in components, greater advantage is expected where the use of electrical heaters is limited and a physically larger system is involved.

Figure 12 compares the more significant heating conditions with the controlled overshoot cycle. The response of item 22 (slowest responding element) is plotted for all conditions. The controlled overshoot condition using nitrogen pressurizing gas and free convection shows the temperature rise time is similar to a condition of a normal heat cycle using helium pressurizing gas with free convection. This is an improvement over the nitrogen free convection condition using the design thermal cycle of 1.8 hours.

2.4 CONCLUSIONS

There is no particular advantage in the forced convection condition of helium over nitrogen. The response time of the system is identical with either. The time required for the slowest responding element to reach stabilization is approximately 3 hours. Using helium with free convection stabilization can be achieved in approximately 4.5 hours. Using nitrogen with free convection stabilization occurs in approximately 6.3 hours.

The time required to cool to room temperature is quite lengthy for all conditions since little can be done to accelerate heat dissipation of the insulated components.

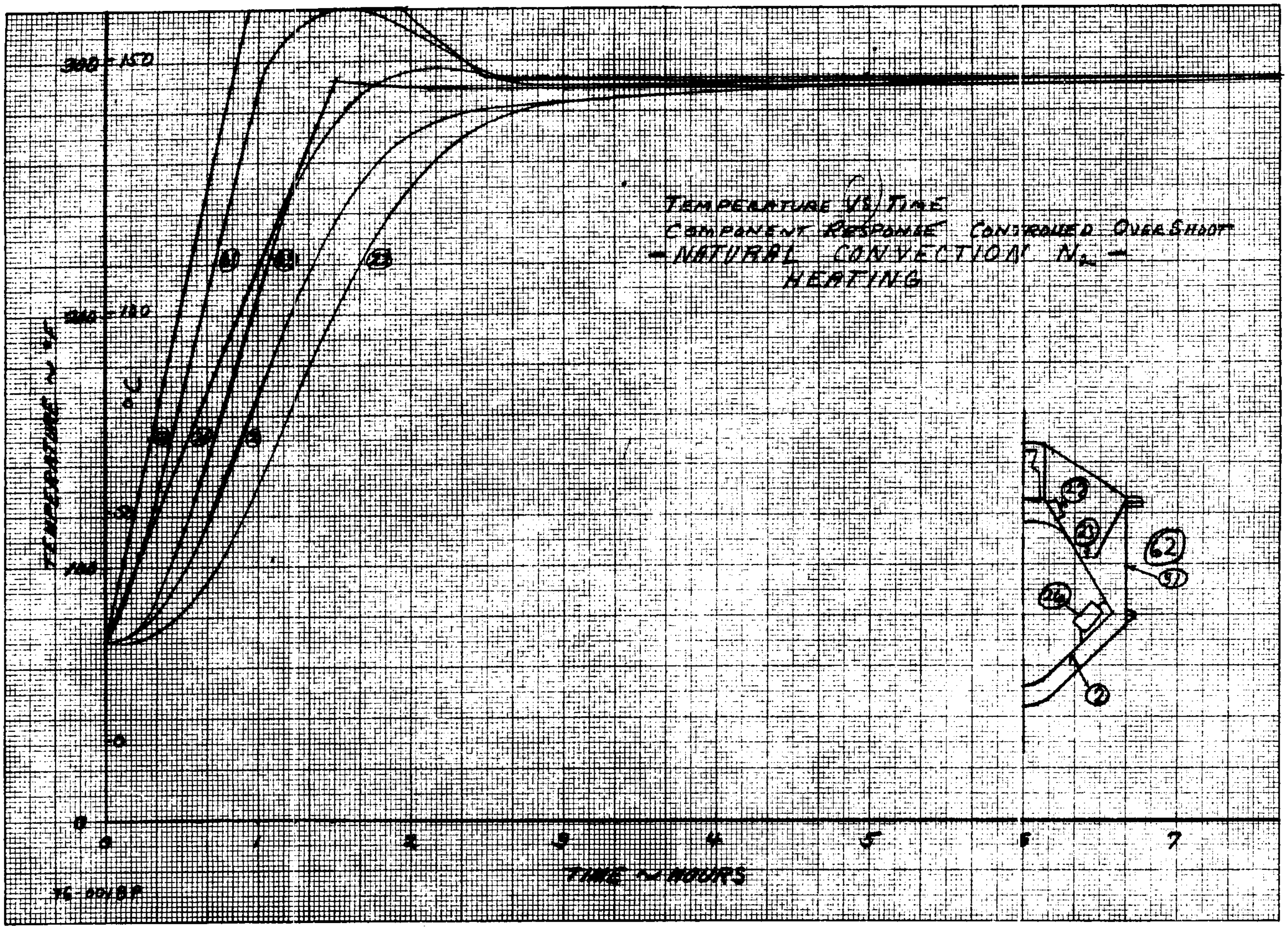


Figure 11 TEMPERATURE VERSUS TIME COMPONENT RESPONSE CONTROLLED OVERSHOOT NATURAL CONVECTION N_2 HEATING

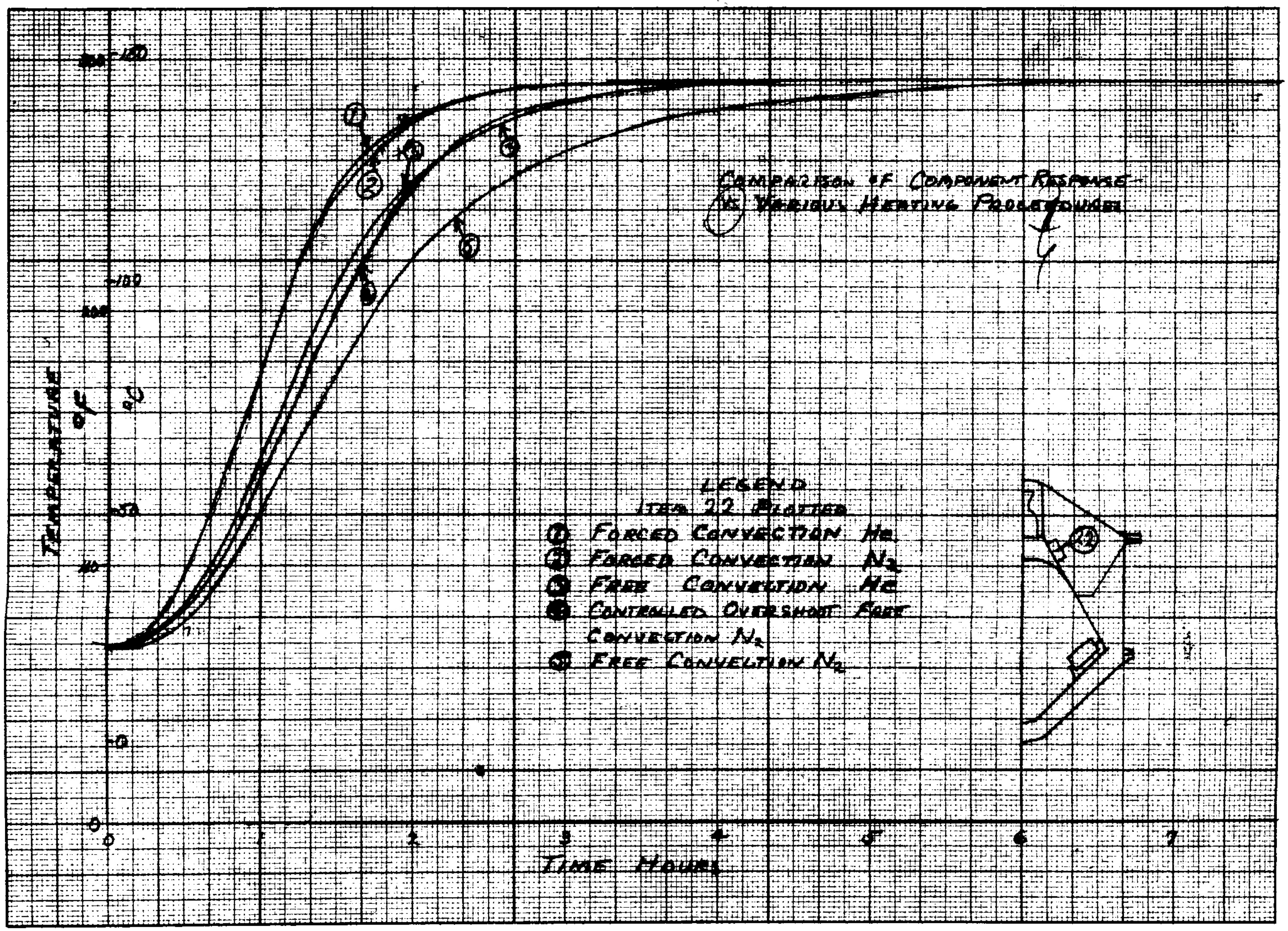


Figure 12 COMPARISON OF COMPONENT RESPONSE FOR VARIOUS HEATING PROCEDURES

3. STRUCTURAL ANALYSIS

3.1 GENERAL DISCUSSION

Structural performance predictions of the system were completed in the second quarter. The stress analysis was performed at a time 1 hour after initiation of the heating cycle and 1 hour after initiation of the cooling cycle. Previous analysis performed on the preliminary design indicated that the structure would pass through the maximum stresses due to the thermal heat cycle at those times. Nitrogen pressurizing gas, with free and forced convection conditions inside the sterilization container, produces the extreme stress limits the assembly encounters as a result of the thermal cycle. The mathematical model used in the analysis is shown in figure 13. The method of analysis used was described in the first quarterly progress report (RAD-SR-65-264, dated 15 October 1965). Results indicate that stresses well below allowable will develop during thermal cycling and no permanent distortions are expected.

3.2 STRUCTURAL PERFORMANCE PREDICTION

3.2.1 Nitrogen-Free Convection Heating

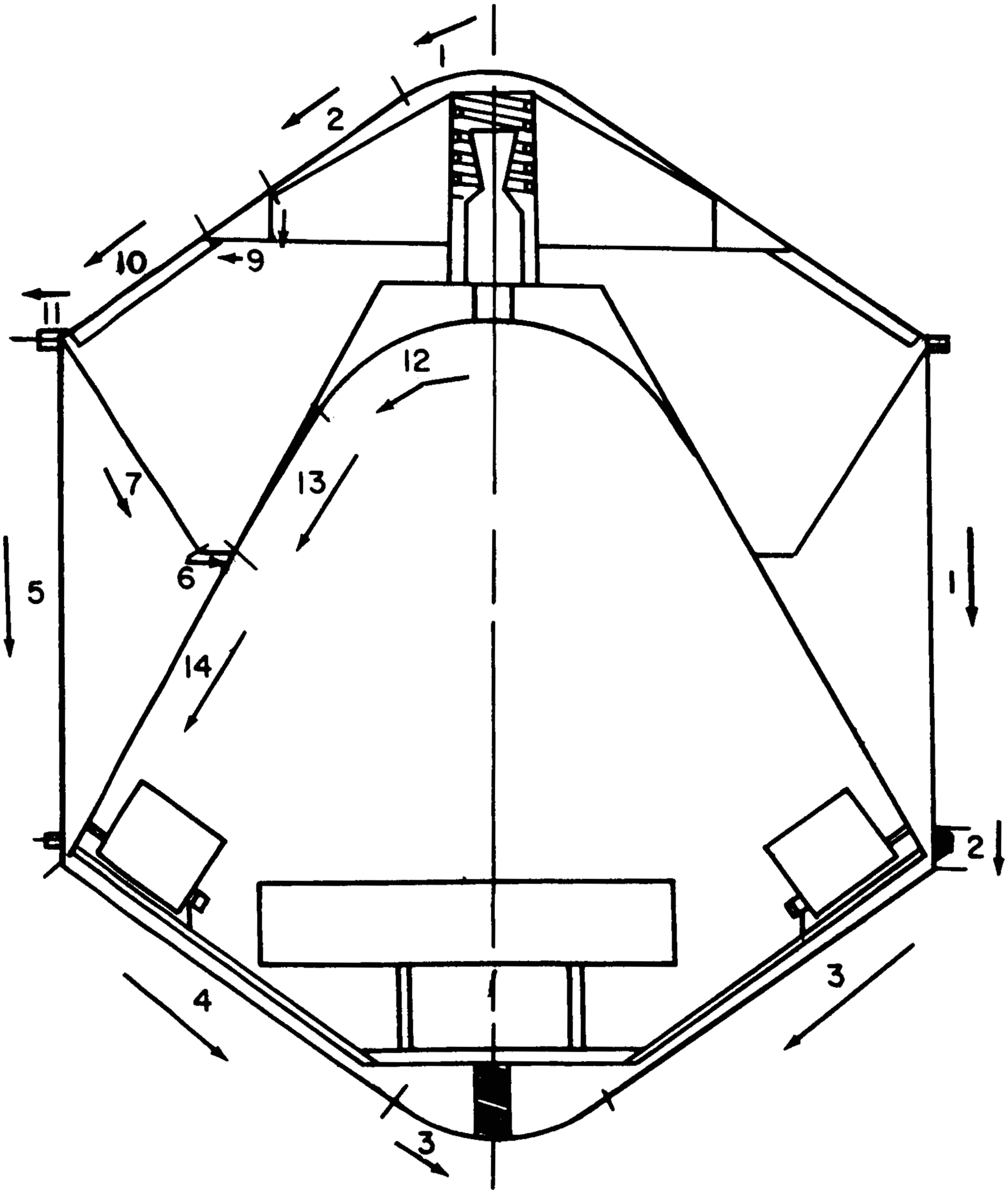
The thermal gradients for the condition using nitrogen gas in the sterilization container, under free convection heating, at a period of 1 hour after initiation of the heating phase, is shown in figure 14. Figures 15 and 16 are plots of the internal and external meridional and circumferential stresses in the sterilization container. The maximum stresses calculated were on the order of 3500 psi and are well within the allowable stress range of the material.

3.2.2 Nitrogen-free Convection Cooling

The thermal gradients for the condition using nitrogen gas in the sterilization container, under free convection cooling, at a period of 1 hour after initiation of the cooling phase, are shown in figure 17. Figures 18 and 19 are plots of the internal and external meridional and circumferential stresses in the sterilization container. The maximum stresses calculated are on the order of 1400 psi.

3.2.3 Nitrogen-Forced Convection Heating

Figure 20 shows the thermal gradient in the sterilization container at a time of 1 hour after initiation of the heating phase. Nitrogen



76-0004P

Figure 13 STRUCTURAL ANALYTICAL MODEL

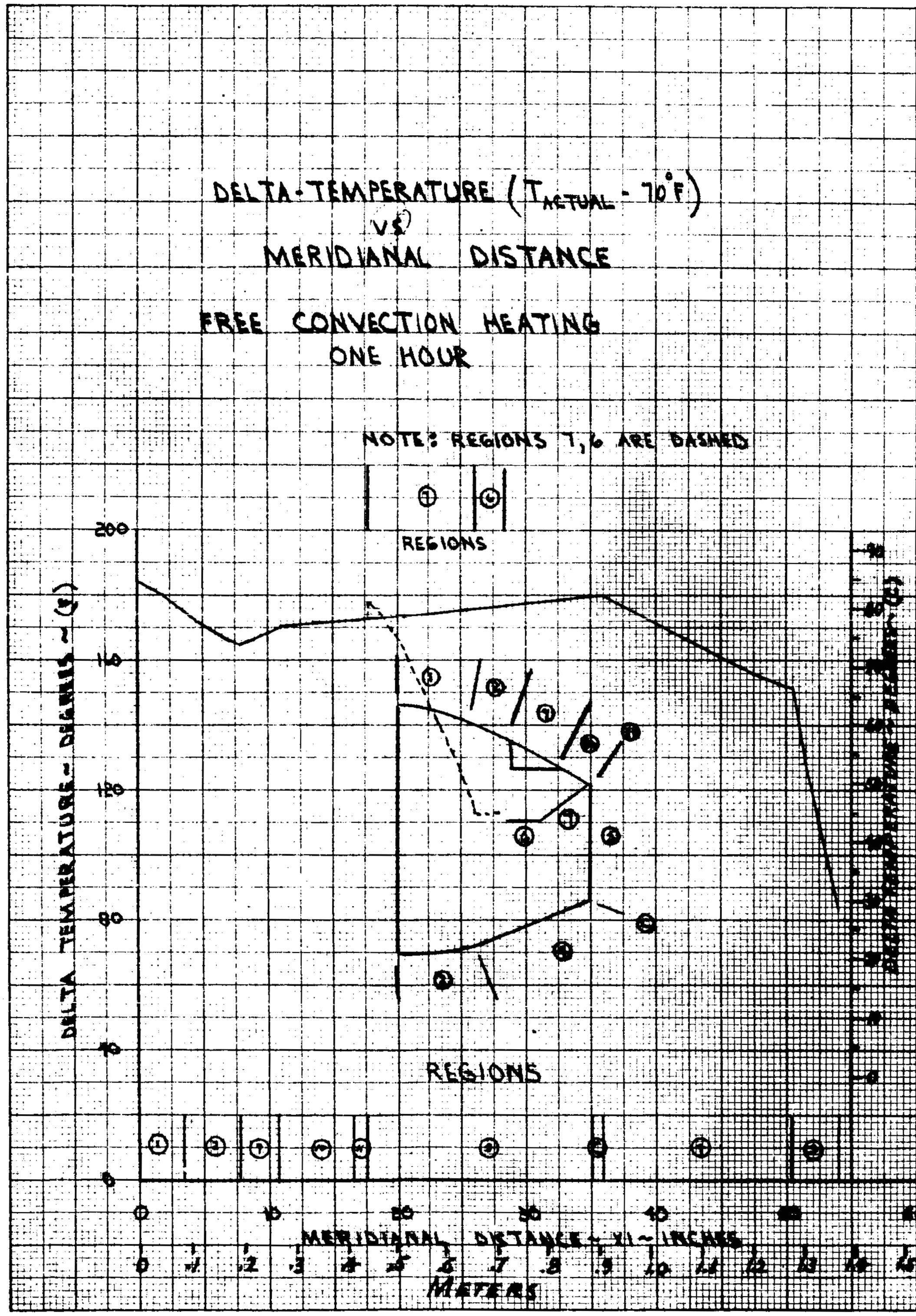


Figure 14 DELTA-TEMPERATURE (T_{actual} -70°F) VERSUS MERIDIONAL DISTANCE
FREE CONVECTION HEATING ONE HOUR

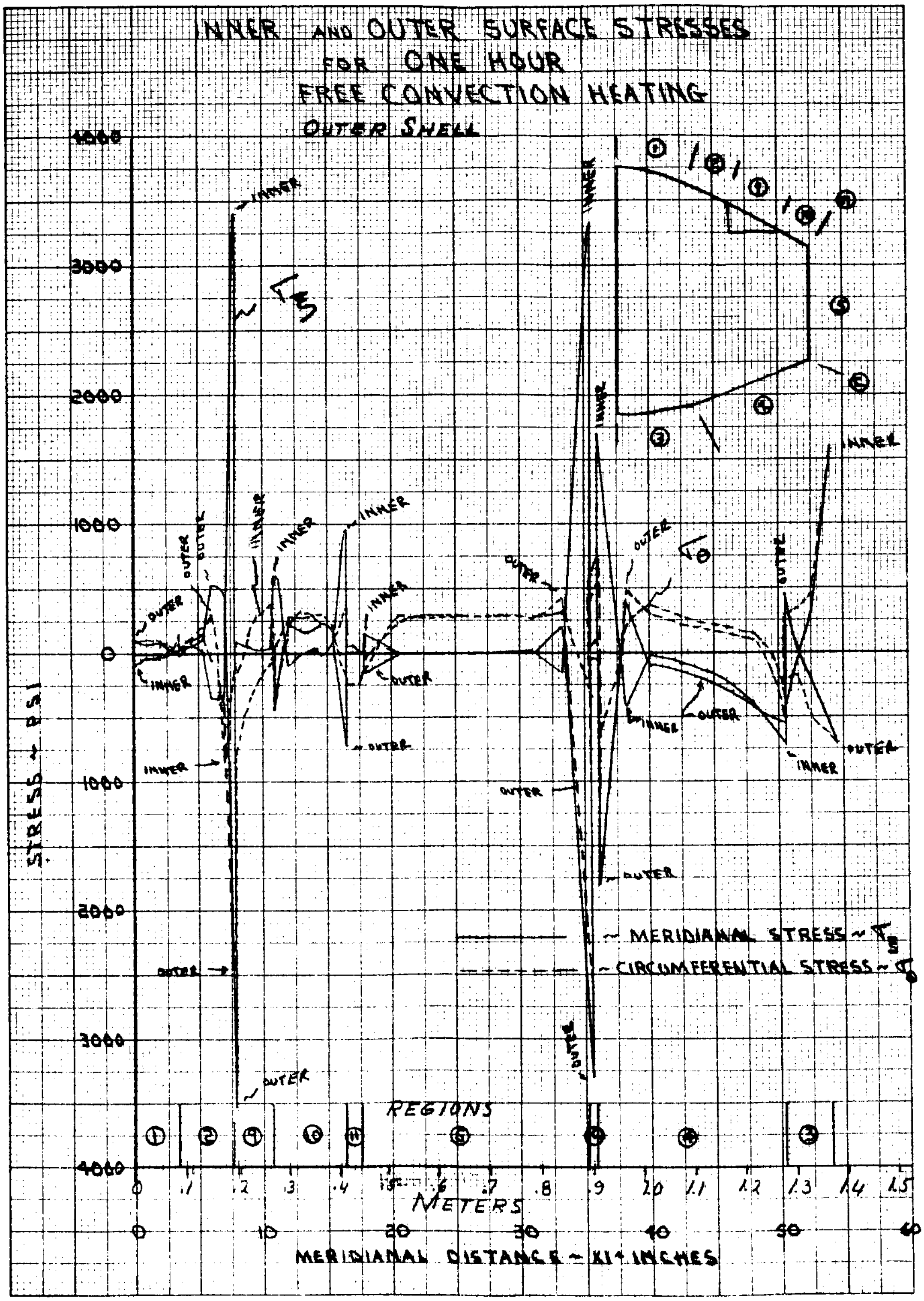


Figure 15 INNER AND OUTER SURFACE STRESSES FOR ONE HOUR FREE CONVECTION HEATING OUTER SHELL

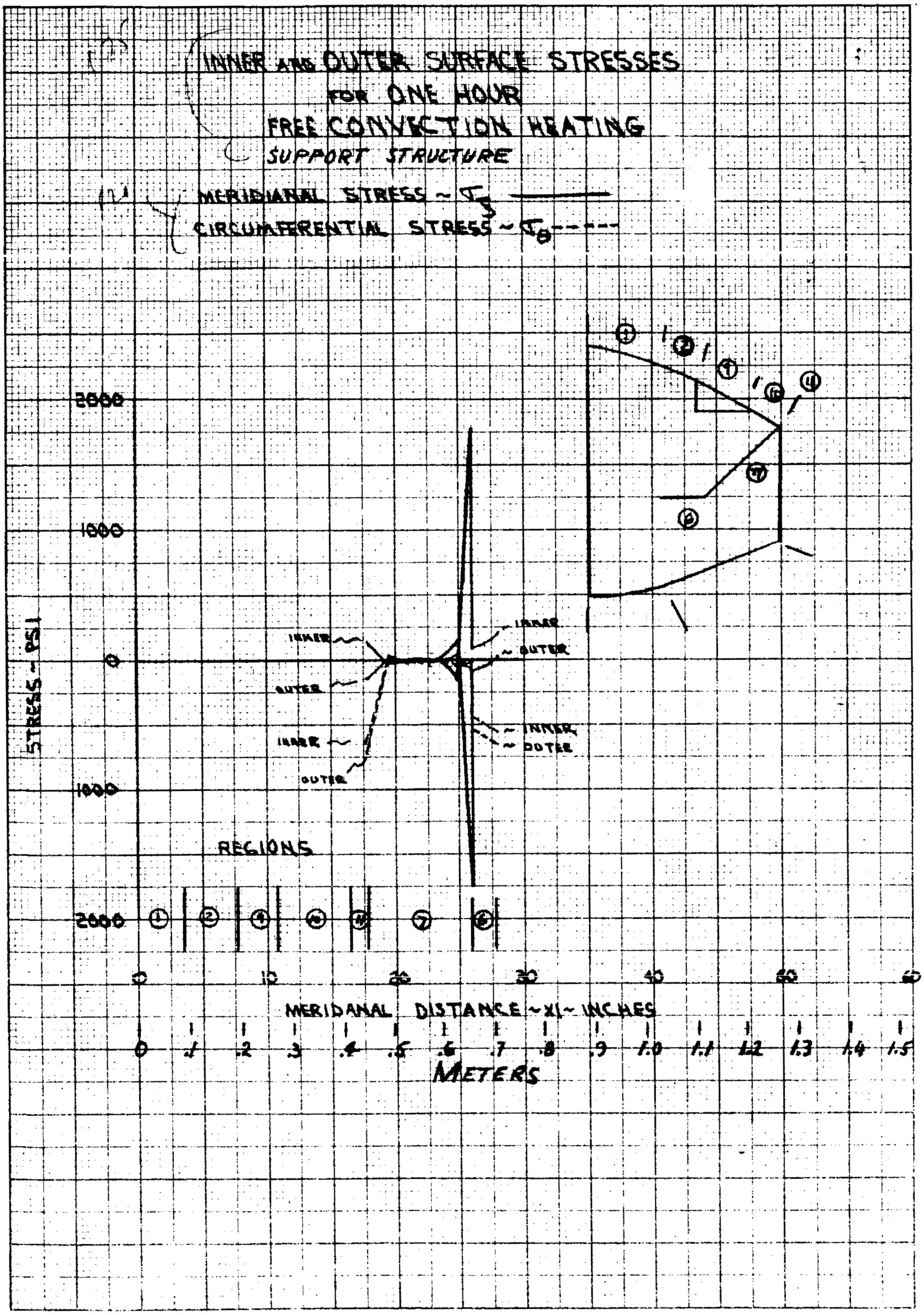


Figure 16 INNER AND OUTER SURFACE STRESSES FOR ONE HOUR FREE CONVECTION HEATING SUPPORT STRUCTURES

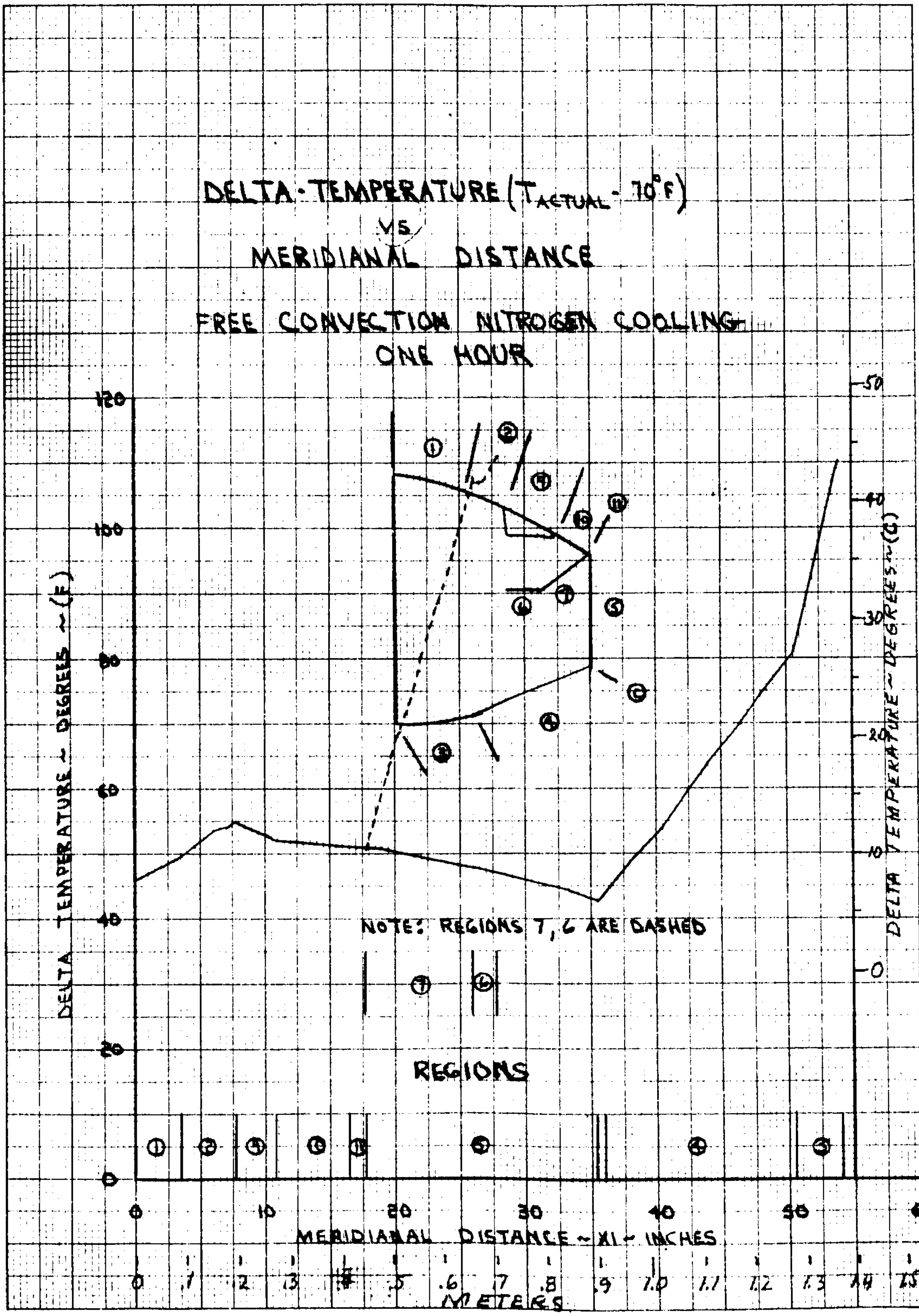


Figure 17 DELTA-TEMPERATURE (T_{actual} -70°F) VERSUS MERIDIONAL AND DISTANCE FREE CONVECTION NITROGEN COOLING ONE HOUR

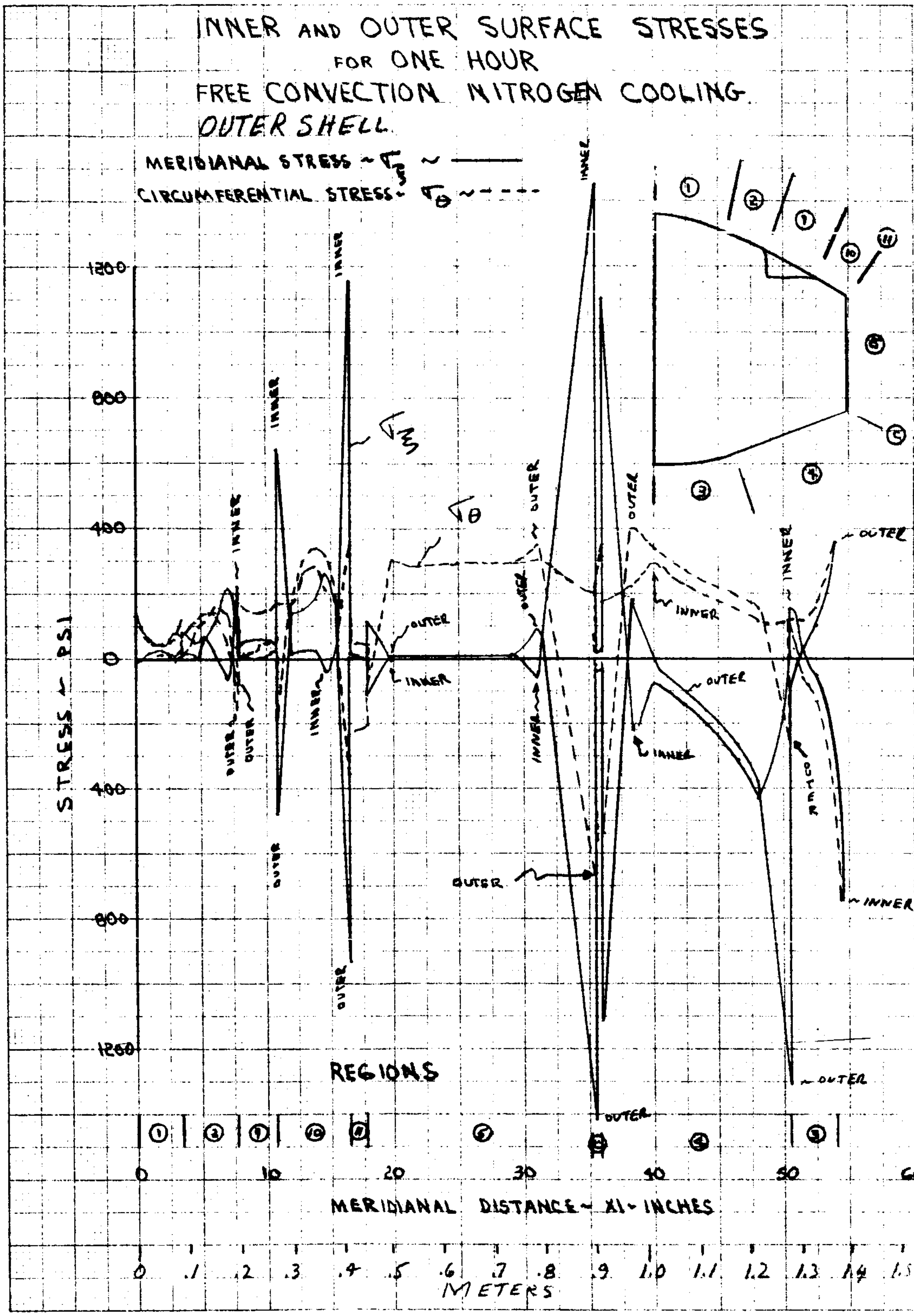


Figure 18 INNER AND OUTER SURFACE STRESSES FOR ONE HOUR FREE CONVECTION NITROGEN COOLING OUTER SHELL

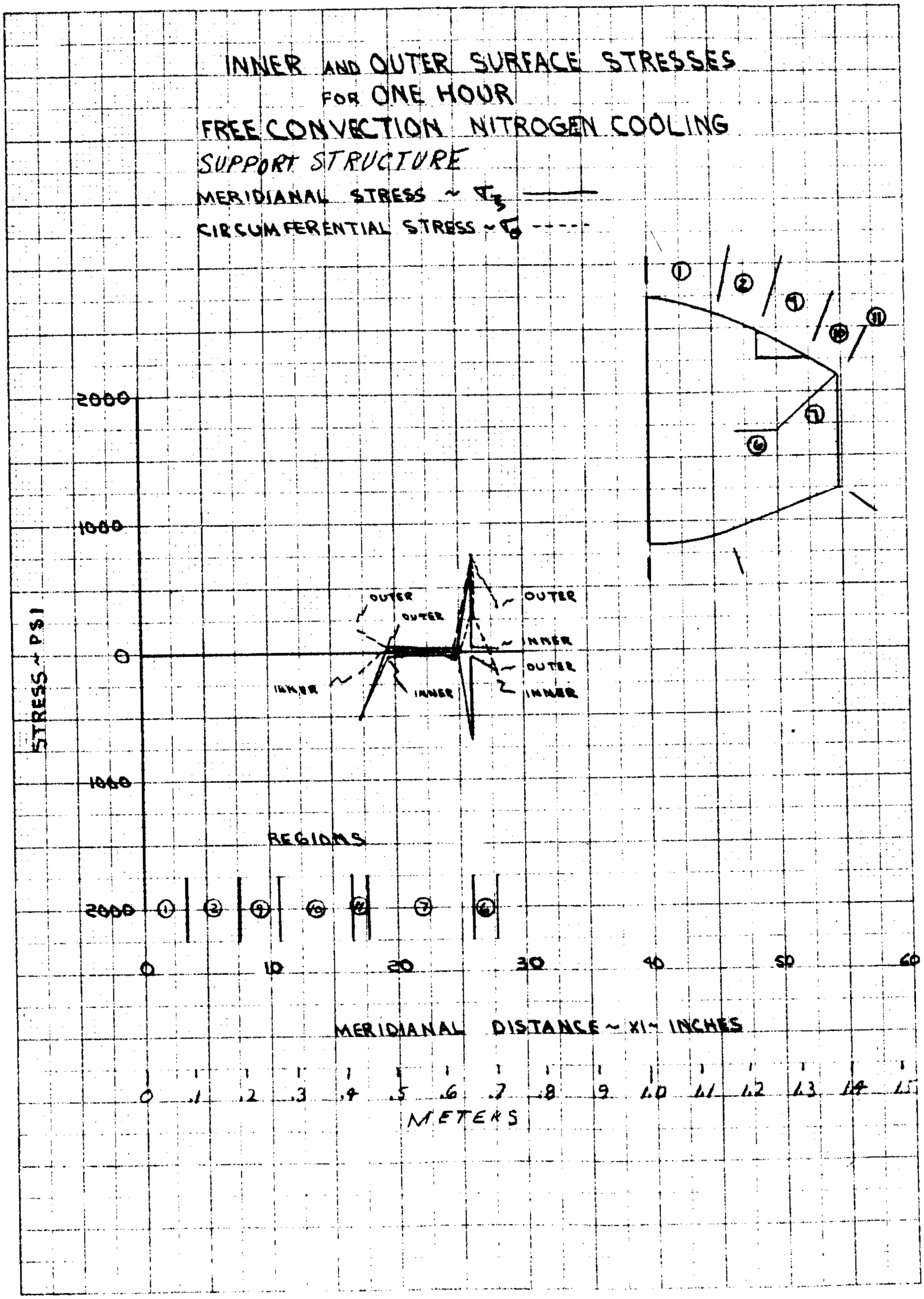


Figure 19 INNER AND OUTER SURFACE STRESSES FOR ONE HOUR FREE CONVECTION NITROGEN COOLING OUTER SHELL

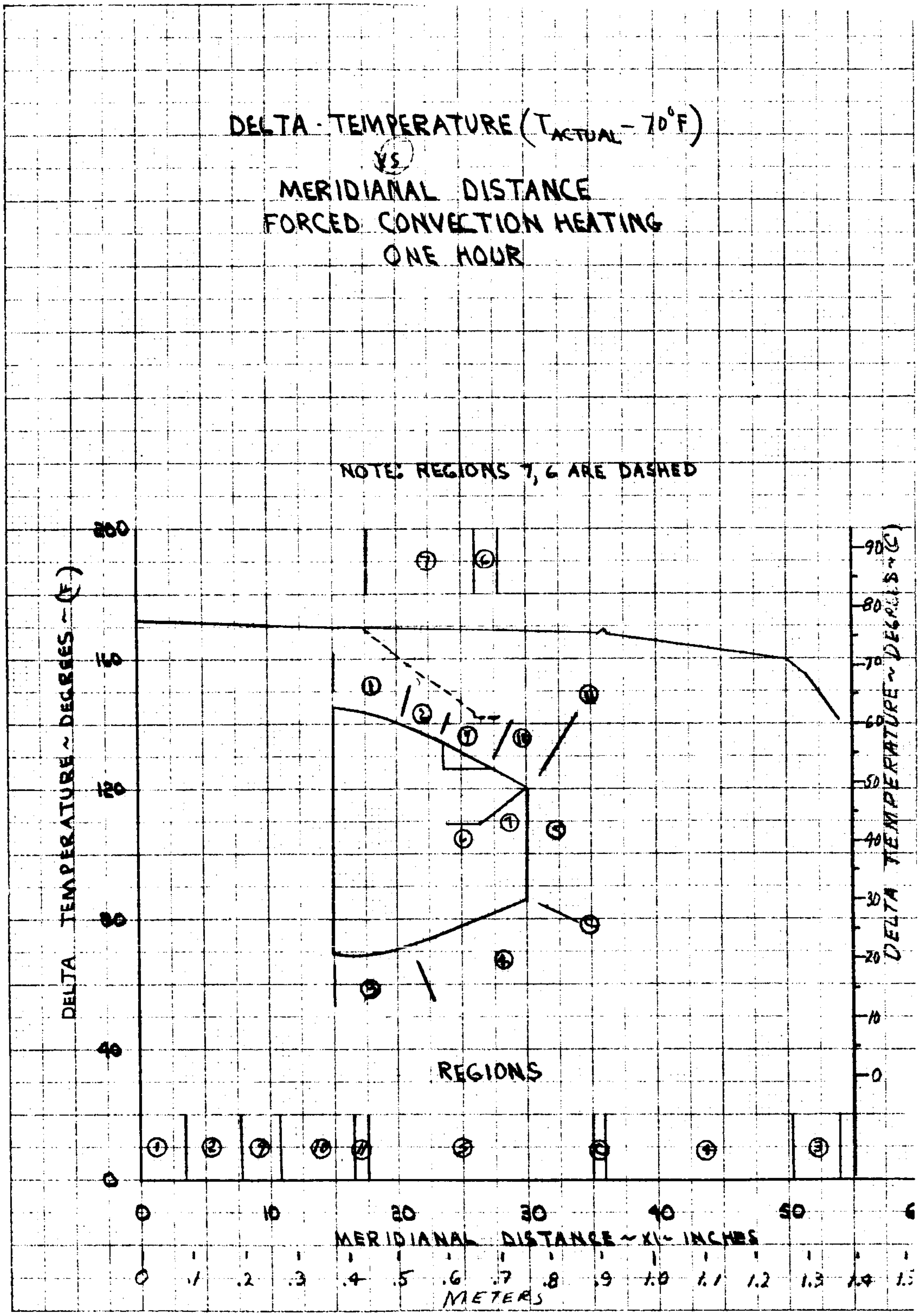


Figure 20 DELTA-TEMPERATURE (T_{actual}-70°F) VERSUS MERIDIONAL DISTANCE FORCED CONVECTION HEATING ONE HOUR

gas was in the sterilization container under forced convection. Figures 21 and 22 are plots of the internal and external meridional and circumferential stresses in the sterilization container. The maximum stresses calculated under the above-mentioned conditions are 3500 psi.

3.2.4 Nitrogen-Forced Convection Cooling

Figure 23 shows the thermal gradient in the sterilization container a time of 1 hour after the initiation of the cooling phase. Nitrogen gas was in the stterilization container under forced convection.

Figures 24 and 25 are plots of the internal and external meridional and circumferential stresses in the sterilization container. The maximum stresses calculated under the above-mentioned conditions are 2100 psi.

3.3 CONCLUSIONS

The highest stress levels encountered by the sterilization container occur 1 hour after initiation of both the heating and cooling portions of the heat cycle. In the free convection heating condition, the stress level in the meridional direction approaches 3500 psi at the junction of elements 2 and 9 in figure 13, and also at element C ("V" band clamp flange). The forced convection heating condition has similar peaks at element C but indicated meridional stress levels approaching 1400 psi between elements 2 and 9. Both free and forced-convection conditions indicate meridional stress levels approaching 2000 psi at the intersection of elements 6 and 7.

Stresses as a result of heat-sterilization-cycle-induced thermal gradients are not great enough to cause permanent distortion of the assembly. Permanent distortion may occur as a result of relieving machining stresses during the thermal cycles.

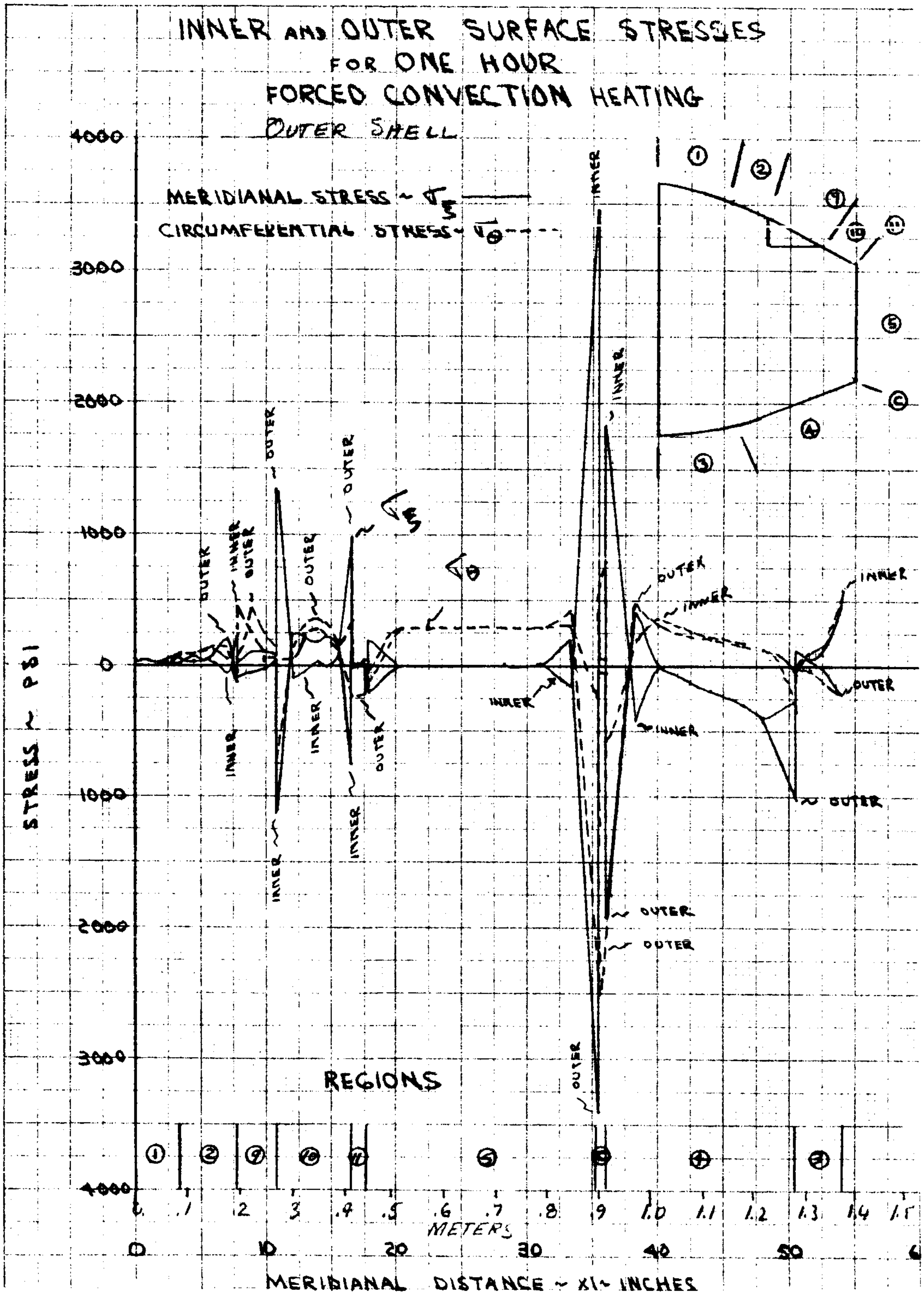


Figure 21 INNER AND OUTER SURFACE STRESSES FOR ONE HOUR FREE CONVECTION HEATING OUTER SHELL

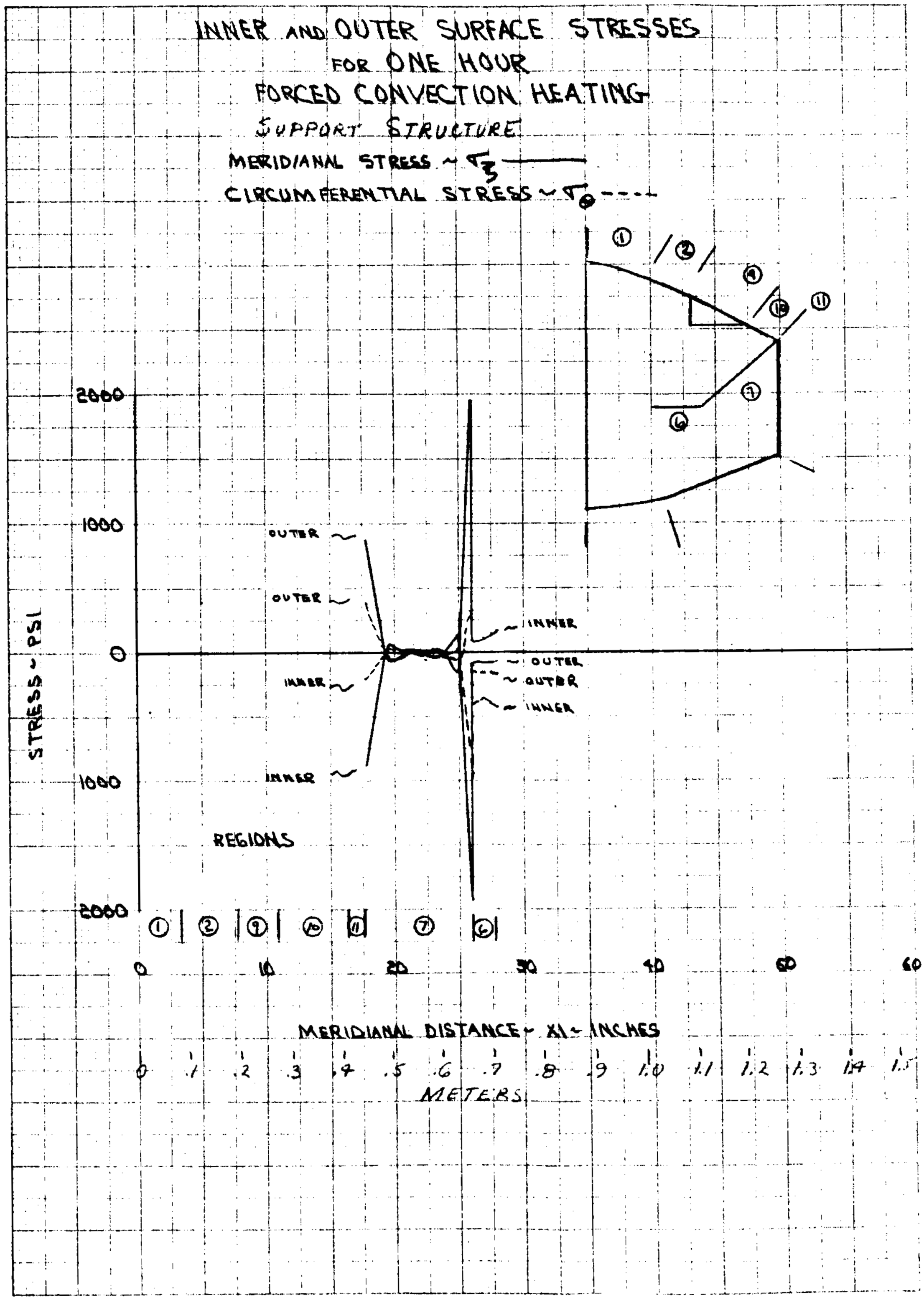


Figure 22 INNER AND OUTER SURFACE STRESSES FOR ONE HOUR FORCED CONVECTION HEATING SUPPORT STRUCTURE

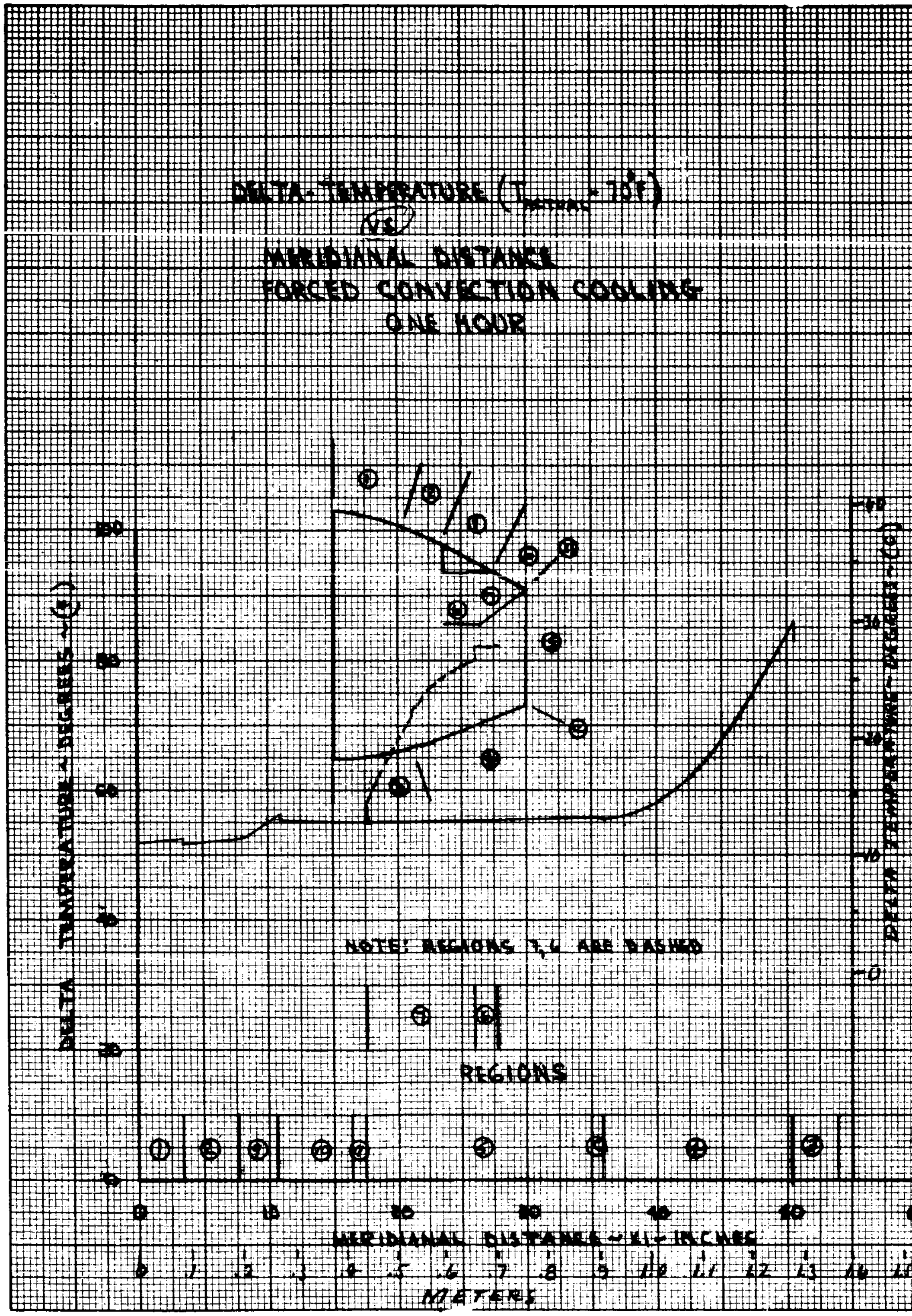


Figure 23 DELTA-TEMPERATURE (T_{actual}-70°F) VERSUS MERIDIONAL DISTANCE FORCED CONVECTION COOLING ONE HOUR

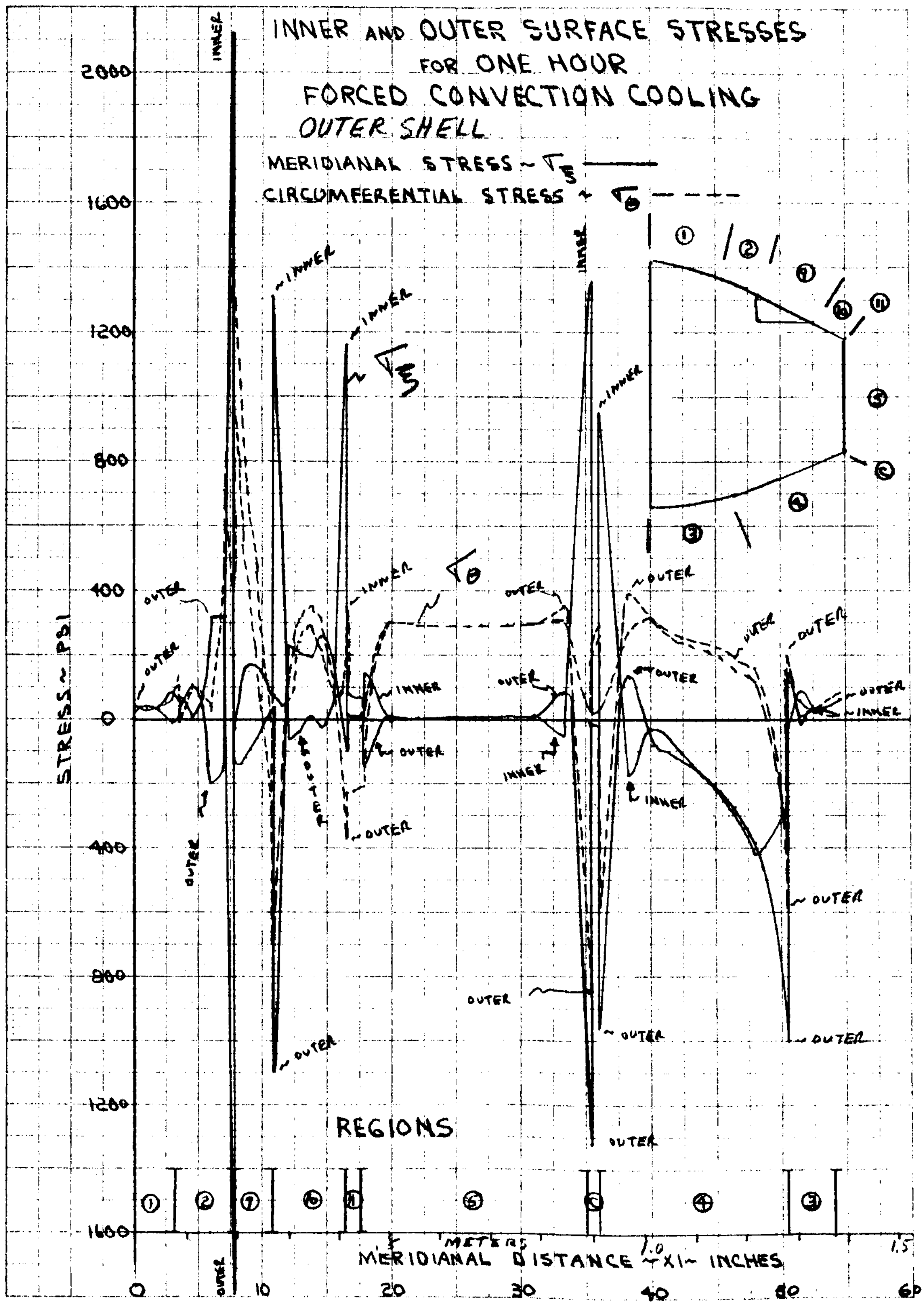


Figure 24 INNER AND OUTER SURFACE STRESSES FOR ONE HOUR FORCED CONVECTION COOLING OUTER SHELL

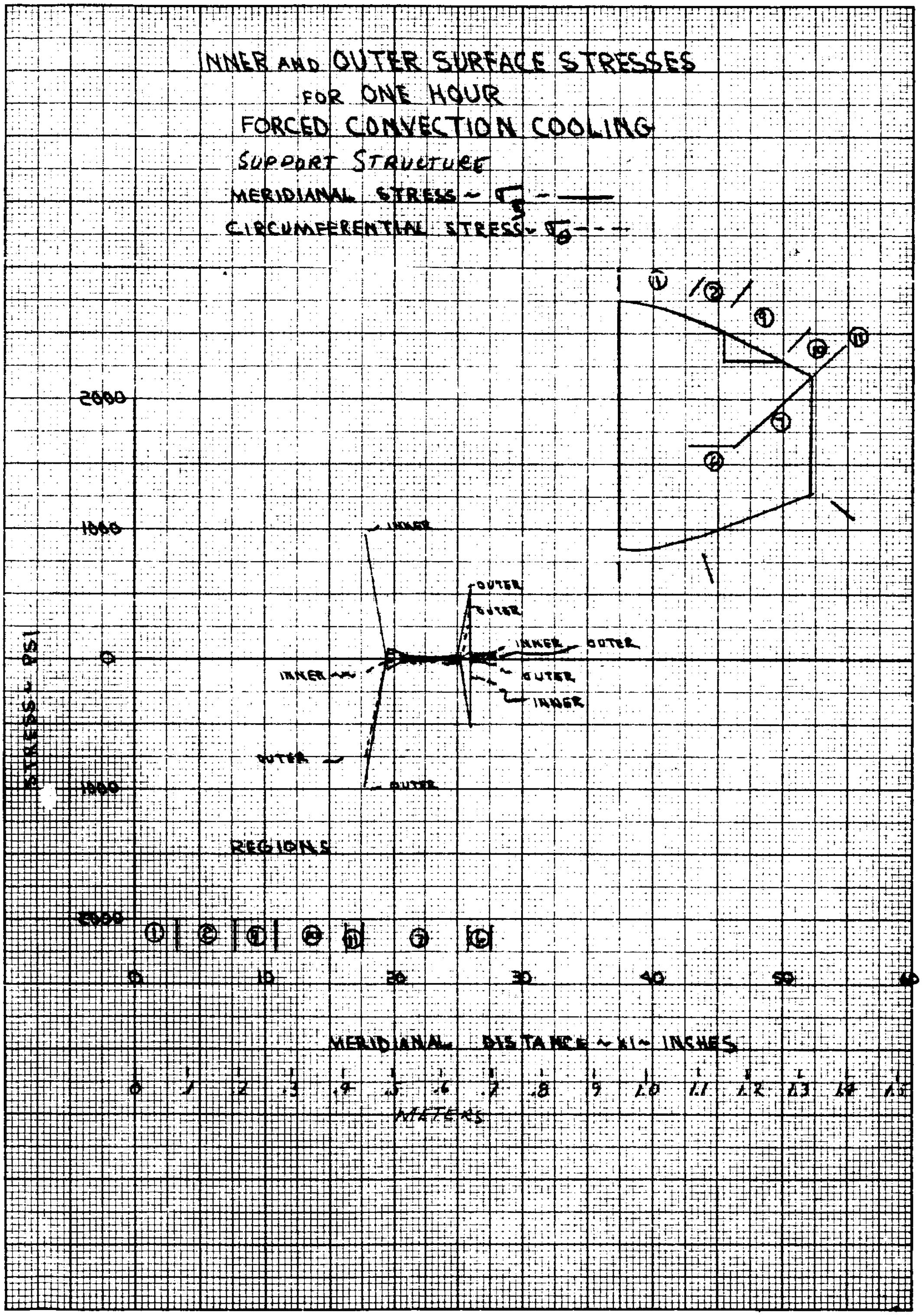


Figure 25 INNER AND OUTER SURFACE STRESSES FOR ONE HOUR FORCED CONVECTION COOLING OUTER SHELL

4. MANUFACTURING

4.1 GENERAL DISCUSSION

The fabrication of the sterilization container and model probe assembly is proceeding as scheduled. All major subassemblies are completed with the exception of final machining and finishing operations. Fabrication of all tooling has proceeded on an "as required" basis. Minor modifications were made to the original design to facilitate fabrication.

4.2 TOOLING APPROACH

As mentioned in preceding reports, all tooling is of a temporary nature since only one unit is being fabricated. Fixtures and tools are being constructed on an "as required" basis. Tools used as restraining fixtures to locate and hold container parts during welding are also being used for stress-relieving operations.

4.3 FABRICATION STATUS

All major components have been fabricated;only final machining and finishing operations remain to be performed. All purchase items have been received, except heating blankets for the simulated instrumentation packages and the "V" band clamps. These items are expected to be delivered by 24 January 1966.

4.3.1 Propulsion Assembly

The propulsion assembly structure (figure 26) is complete and in final inspection. This assembly is ejected from the sterilization container with the probe. It serves as the amount for the ΔV and spin rocket motors.

4.3.2 Mars Probe Assembly

The main instrumentation package of the dummy probe is complete and ready for instrumentation and final assembly. Figure 27 shows the application of a silicone primer to the model probe prior to the application of the modified purple blend. The purple blend heat shield material was then applied by a spraying operation. Figure 28 shows the vacuum bag molding of the heat shield. With the vacuum bag still in place, the heat shield was then oven cured. Figure 29 shows the final machining stage of the heat shield material and figure 30 shows the assembly after machining.

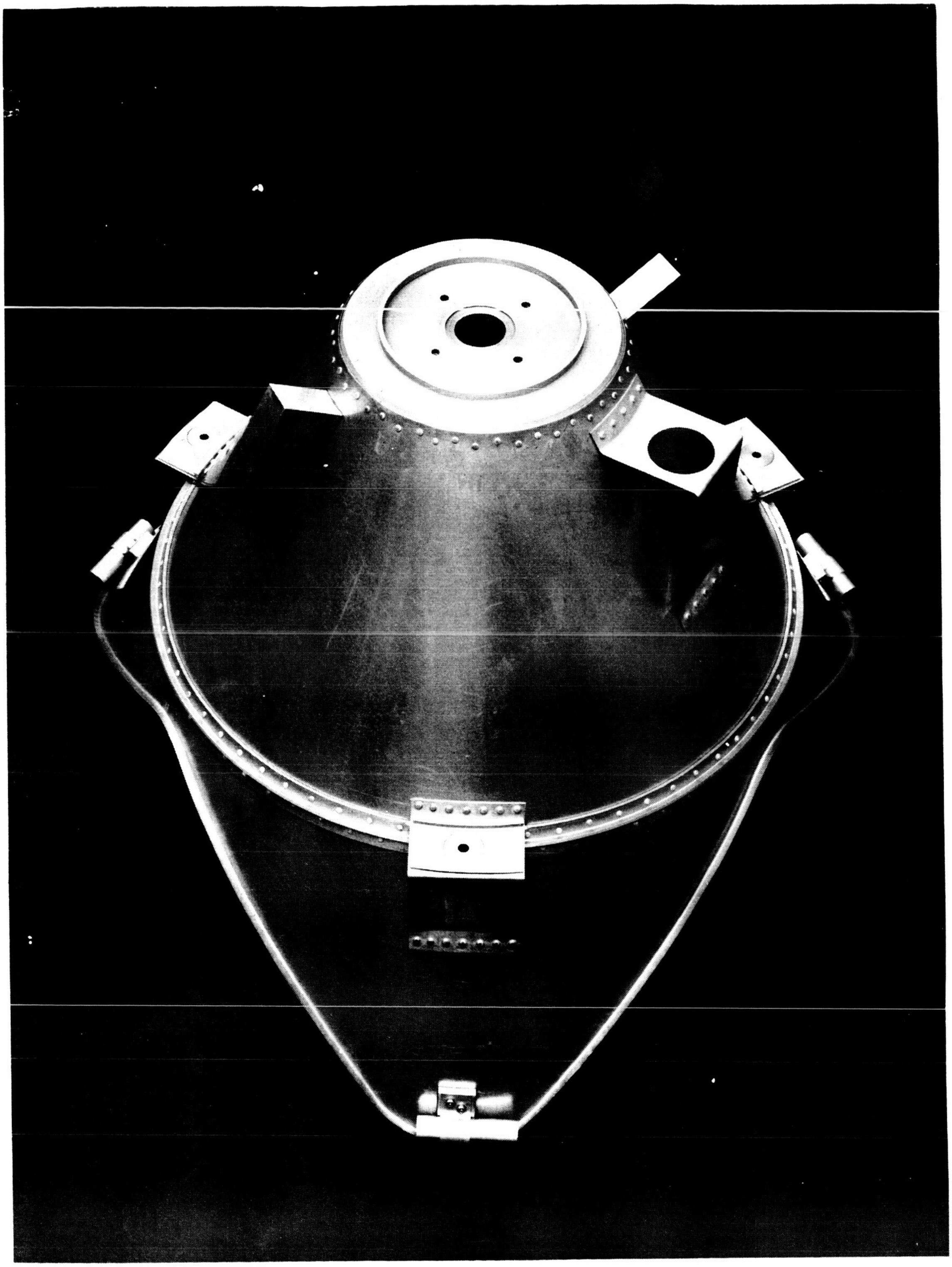


Figure 26 PROPULSION ASSEMBLY
PI4228B

Figure 27 APPLICATION OF SILICONE PRIMER TO PROBE ASSEMBLY
PI6027C

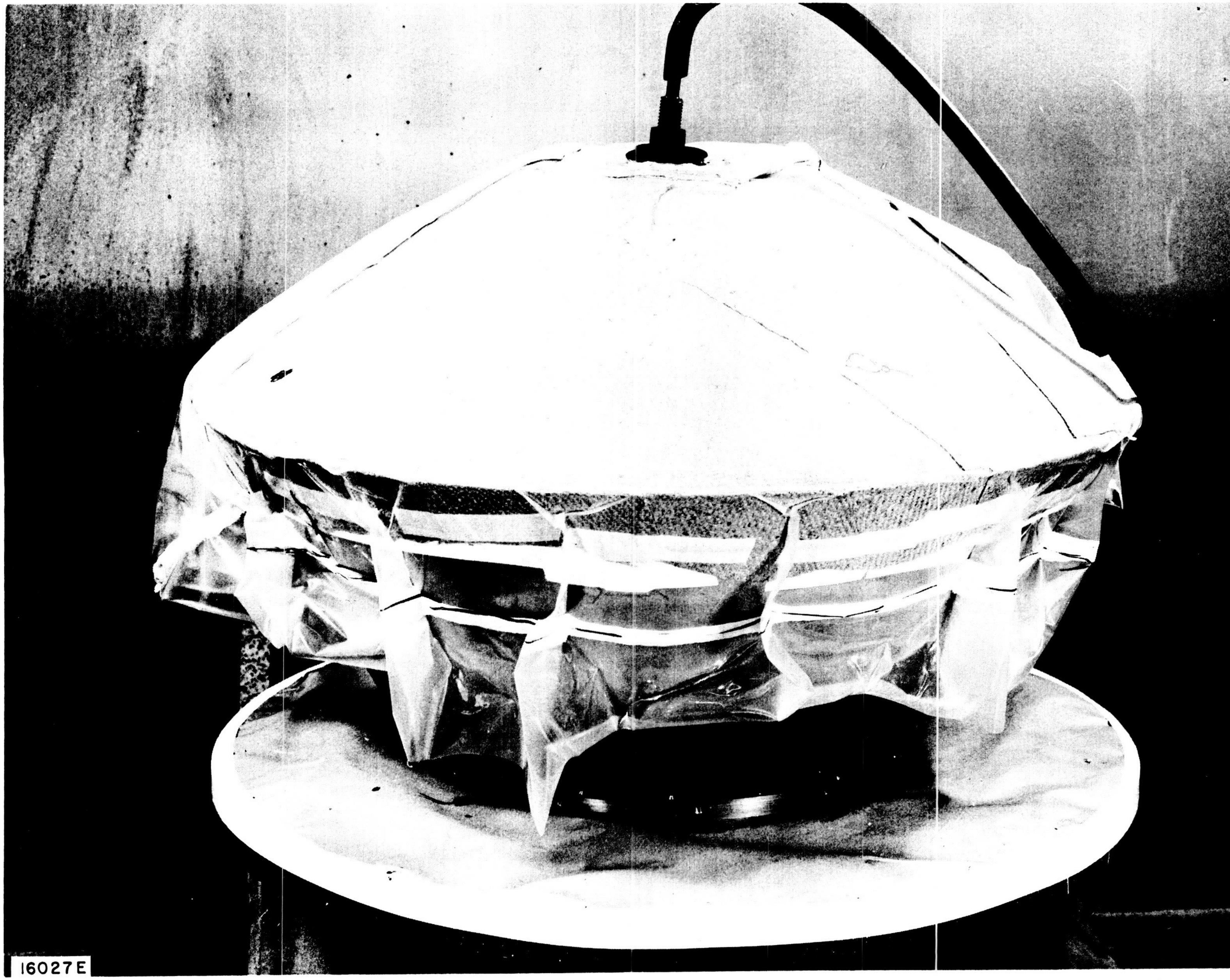


Figure 28 BAG MOLDING HEAT SHIELD MATERIAL
PI6027E

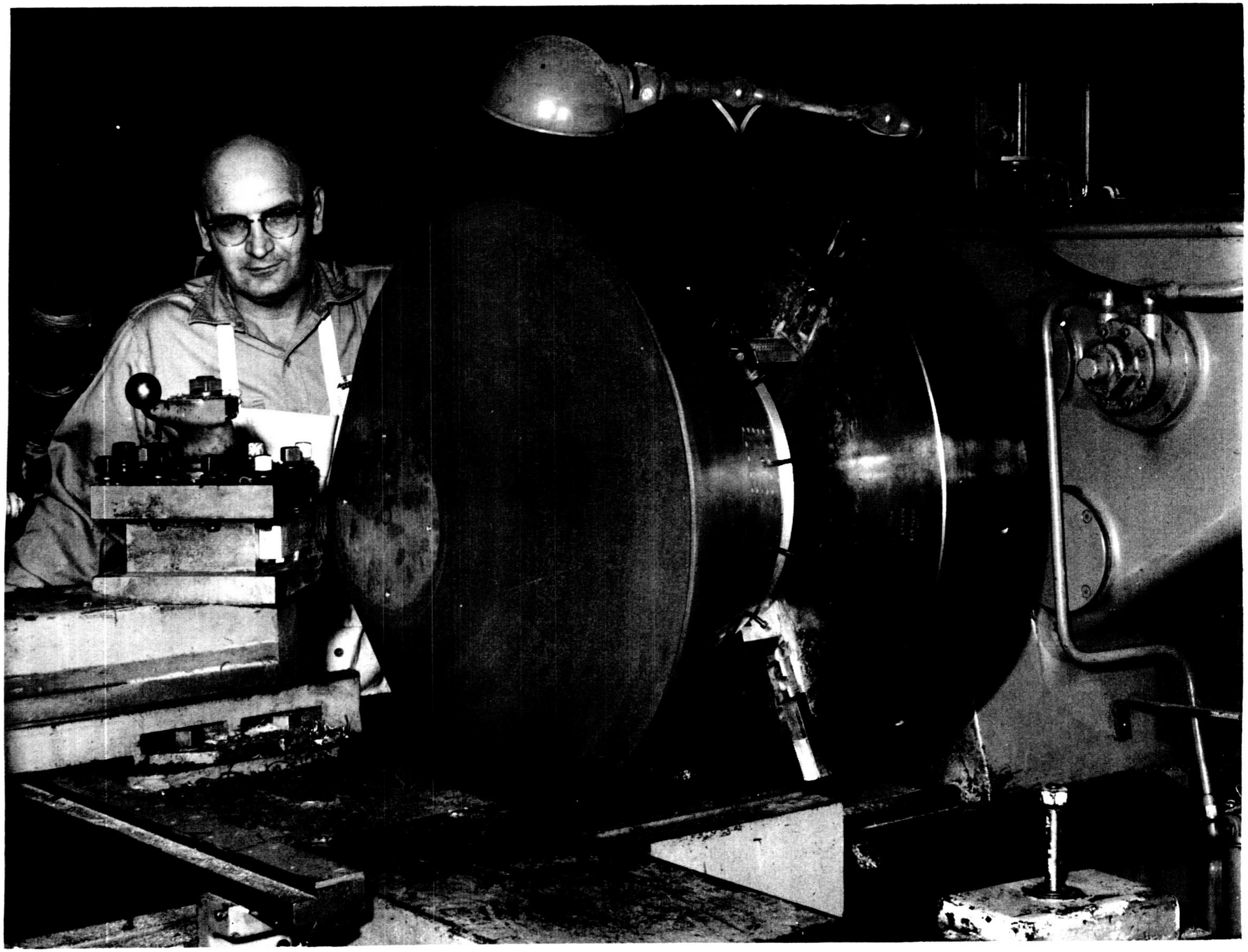


Figure 29 MACHINING PURPLE BLEND HEAT SHIELD
PI4228D

Figure 30 MODEL PROBE ASSEMBLY
PI4228C

4.3.3 Front Cover Assembly

The front cover is in the welded assembly stage and is ready for final machining and finishing. Figure 31 is a view with the cover ejection spring housing welded in place.

4.3.4 Rear Cover Assembly

The rear cover has been assembled and is ready for final machining and finishing. Figure 32 shows the welded and rivited assembly including the probe ejection spring housing.

4.3.5 Container Assembly

The center section of the container (container assembly) is in the final machining stage. Figure 33 shows this section installed in a lathe prior to final machining.

4.4 CONCLUSIONS AND RECOMMENDATIONS

The development of new fabrication techniques are not required for the fabrication of future sterilization containers. However, it is recommended that electronic beam welding be considered for the welding of rings to individual parts in future assemblies. Although tooling may be more expensive, parts could be prefinished and welded with little or no distortion.

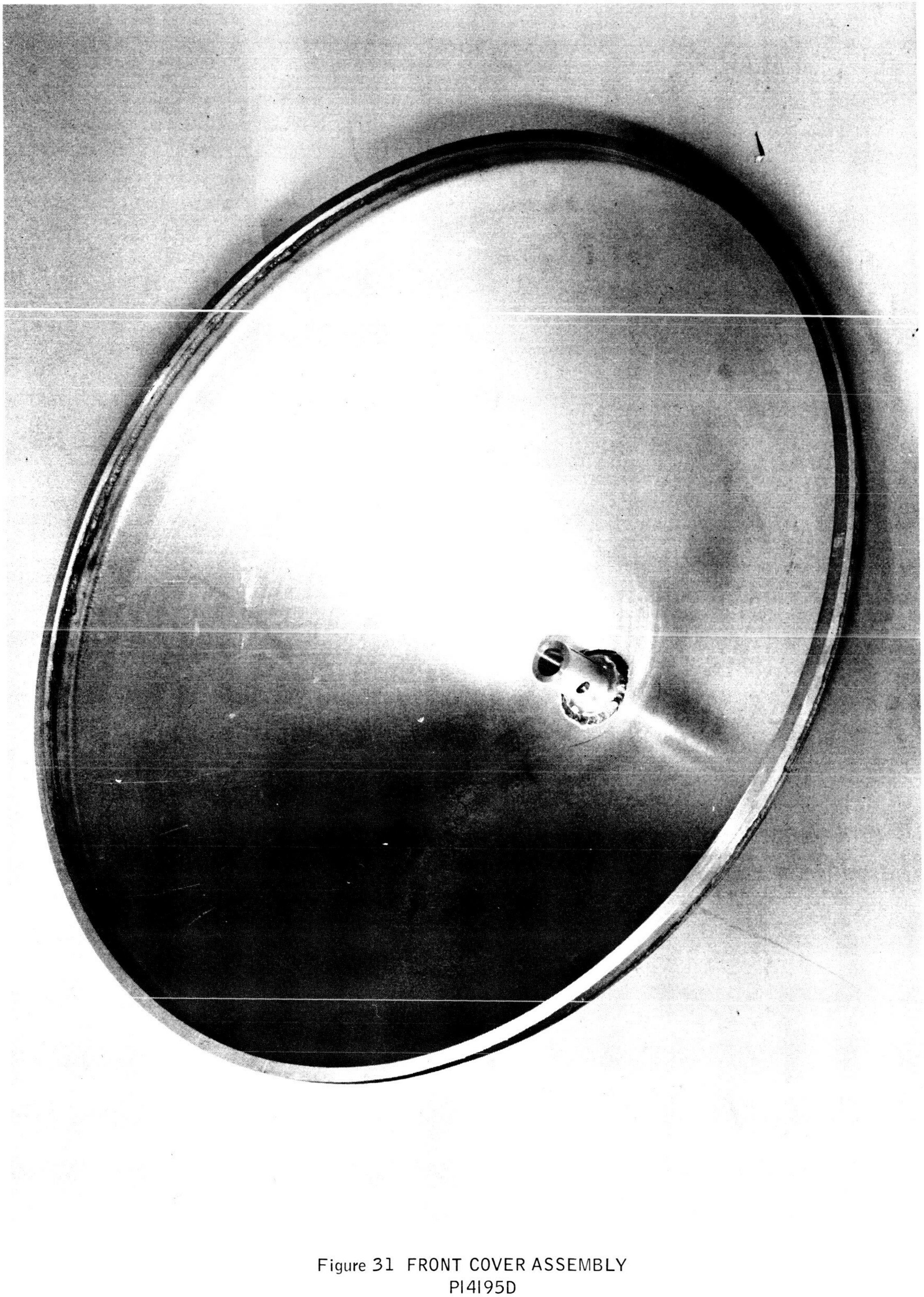


Figure 31 FRONT COVER ASSEMBLY
P14195D

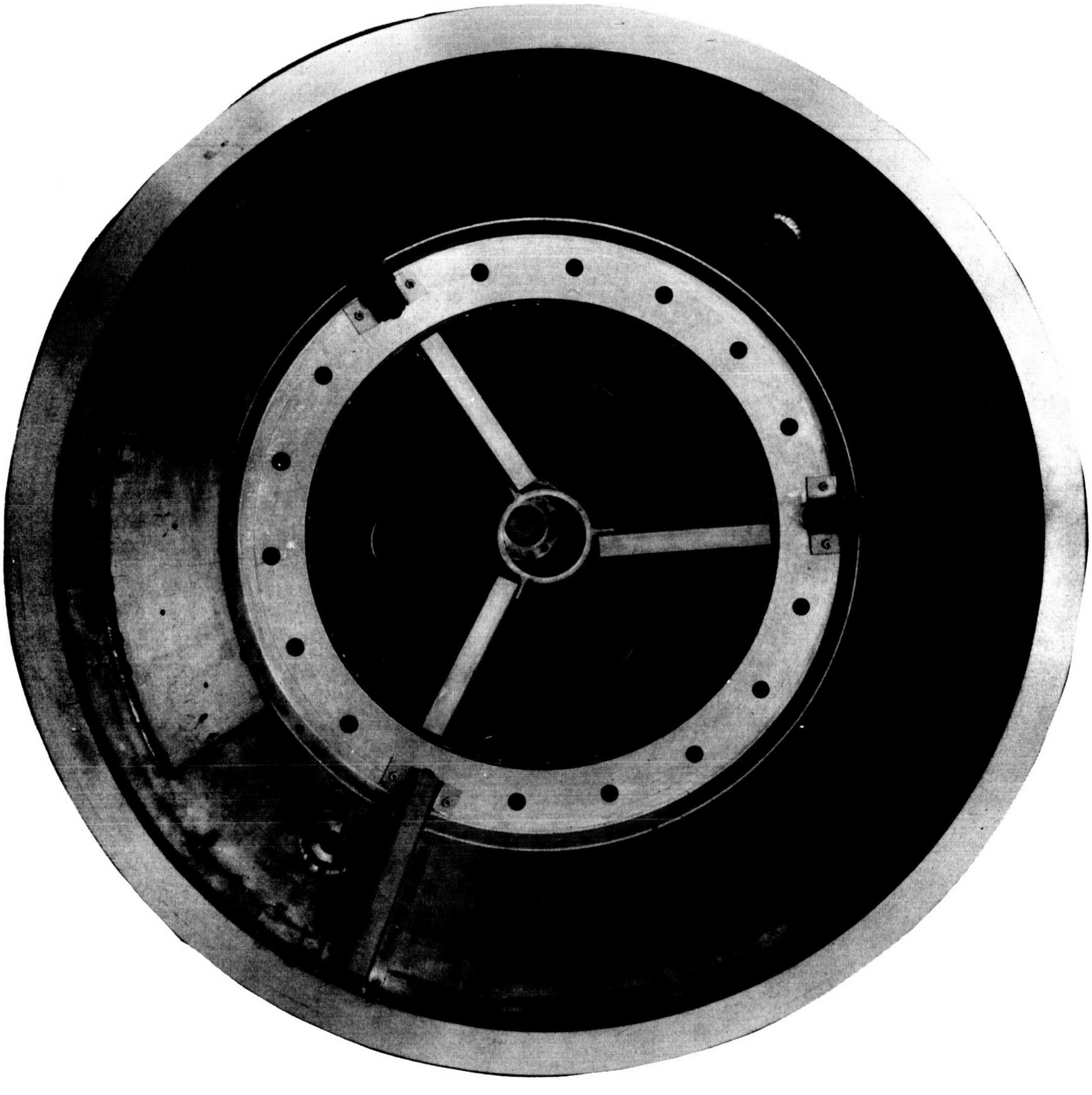


Figure 32 REAR COVER ASSEMBLY
PI4228A

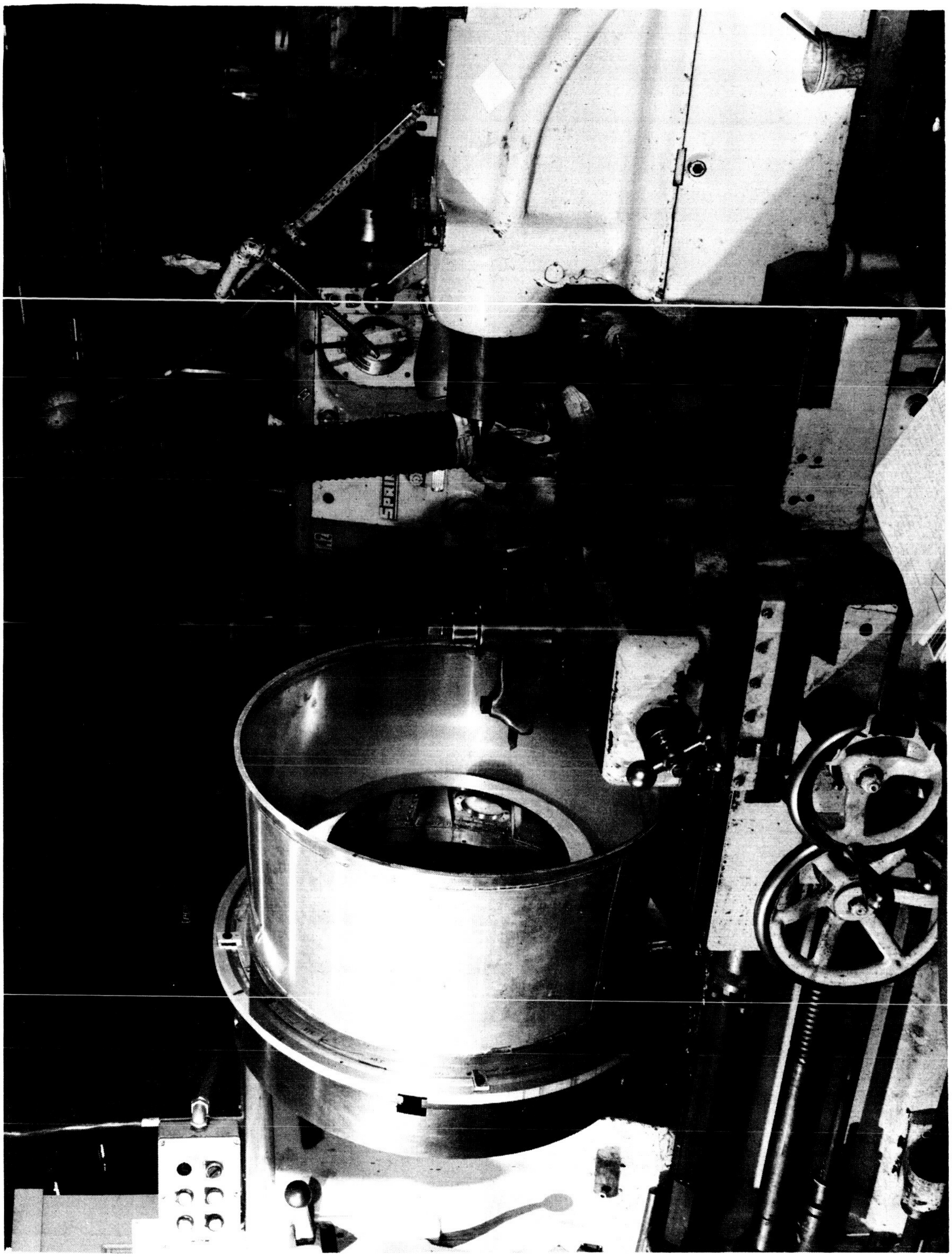


Figure 33 CONTAINER CENTER SECTION
PI4228E

5. TEST

5.1 GENERAL DISCUSSION

The effort in the test area during the second quarter has been the detailing of test plans, test fixture design, test fixture fabrication, instrumentation planning, and the purchasing of instrumentation. The test plan was completed and presented in the first quarterly progress report. The plan has not been modified. The test fixtures were designed and fabrication was initiated. Instrumentation was selected and purchased.

As components of the assembly become available they will be instrumented.

5.2 TEST PLAN

The test plan as presented in the first quarterly progress report (RAD-SR-65-264, dated 15 October 1965) remains unchanged. To ensure maximum information from the tests performed, modification to the test plan may be made as testing progresses.

Figure 34 is a schematic of the separation test setup with the available clearance for deployment.

5.3 TEST FIXTURES

Test fixture details are shown in figure 35. The fixture is made up of a channel section and a stand to which the container assembly will bolt. During heat sterilization cycle tests the channel section will be removed and the stand with the container assembly will be inserted in the oven. The channel section is used only during the probe deployment test.

Figure 36 shows a handling fixture used for supporting the assembly during instrumentation and calibration operations.

Fabrication of the above-mentioned fixtures is in process. They are expected to be completed by the end of January.

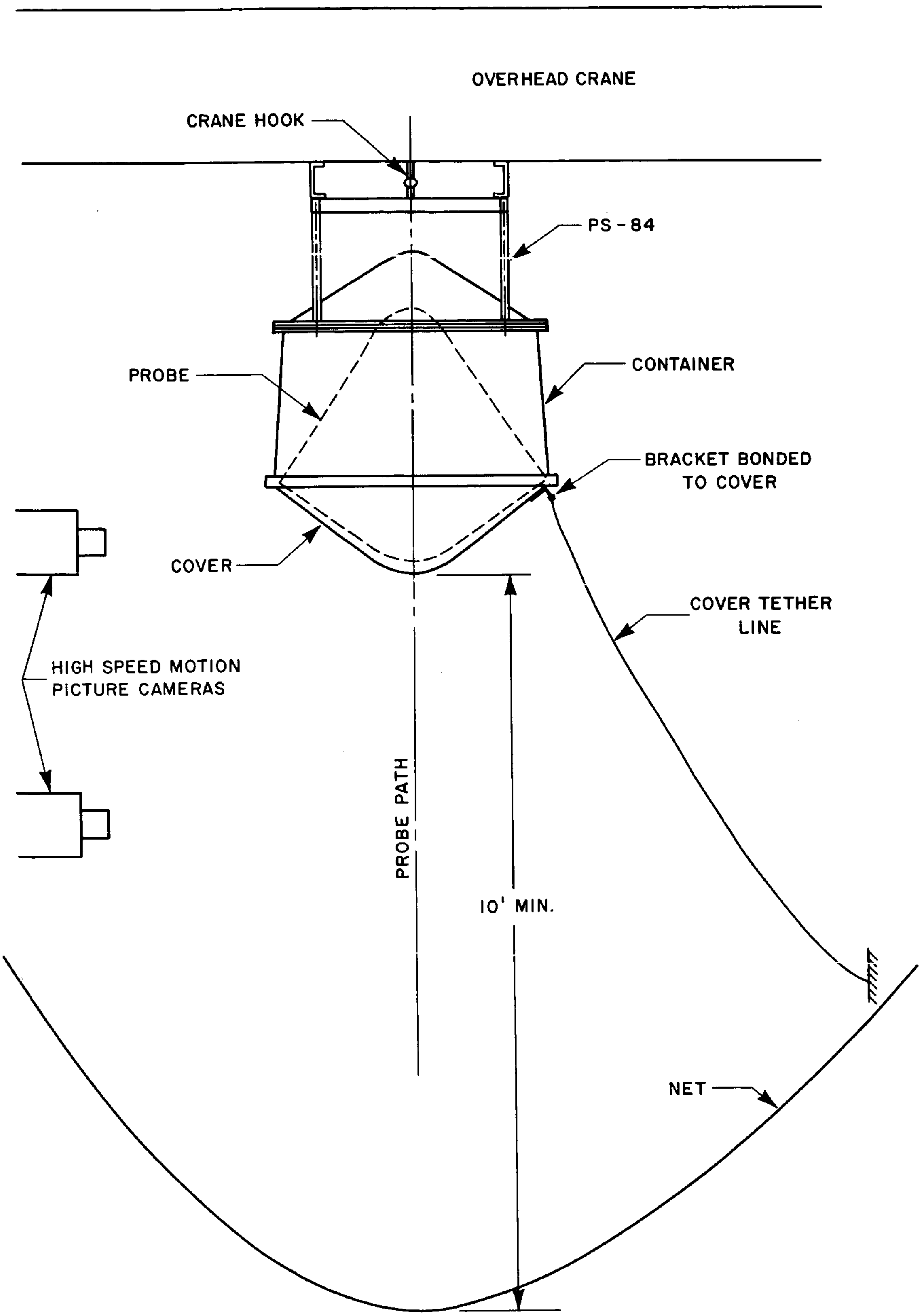


Figure 34 SEPARATION TEST SET-UP

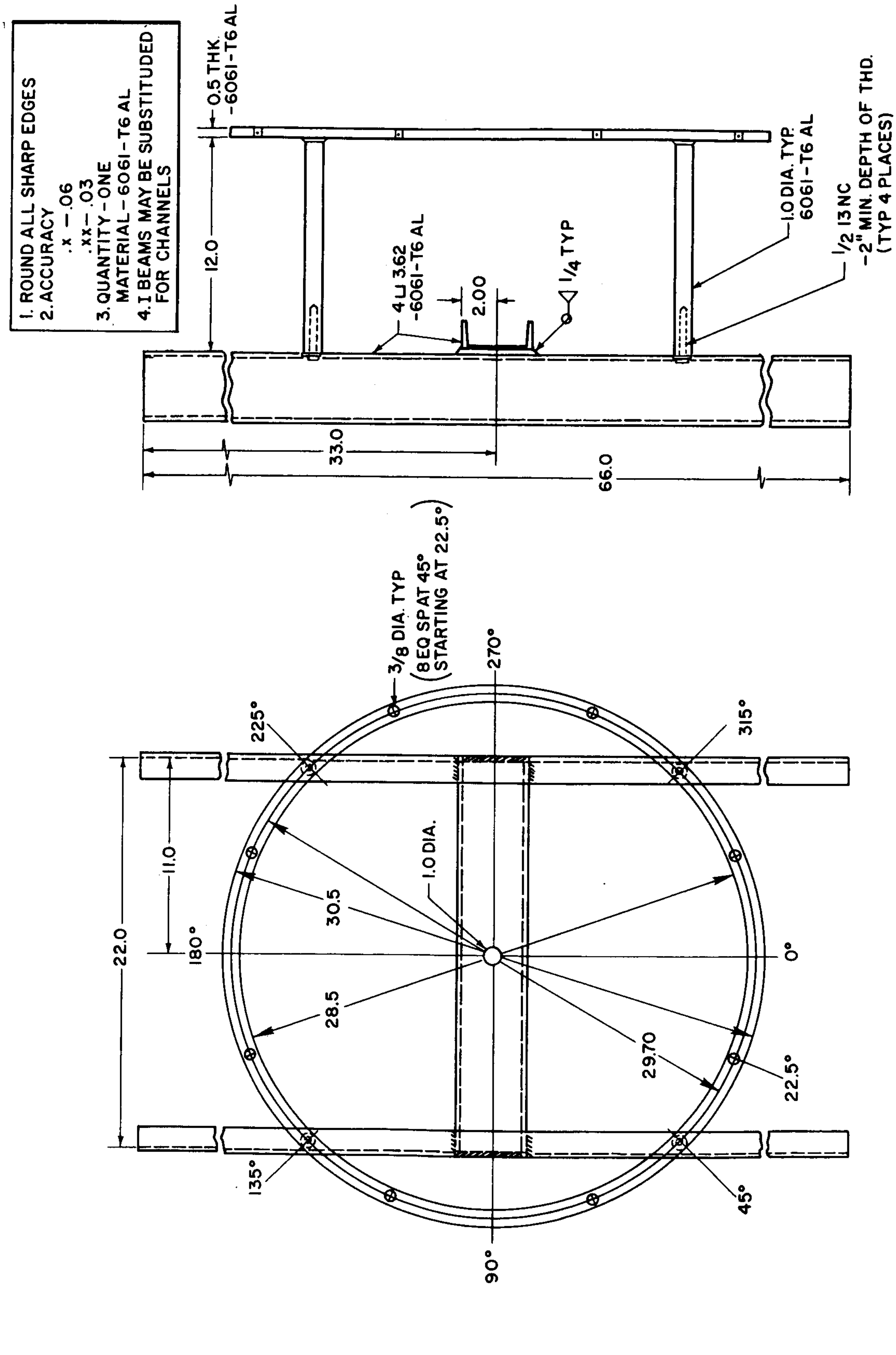


Figure 35 STERILIZATION CONTAINER TEST FIXTURE

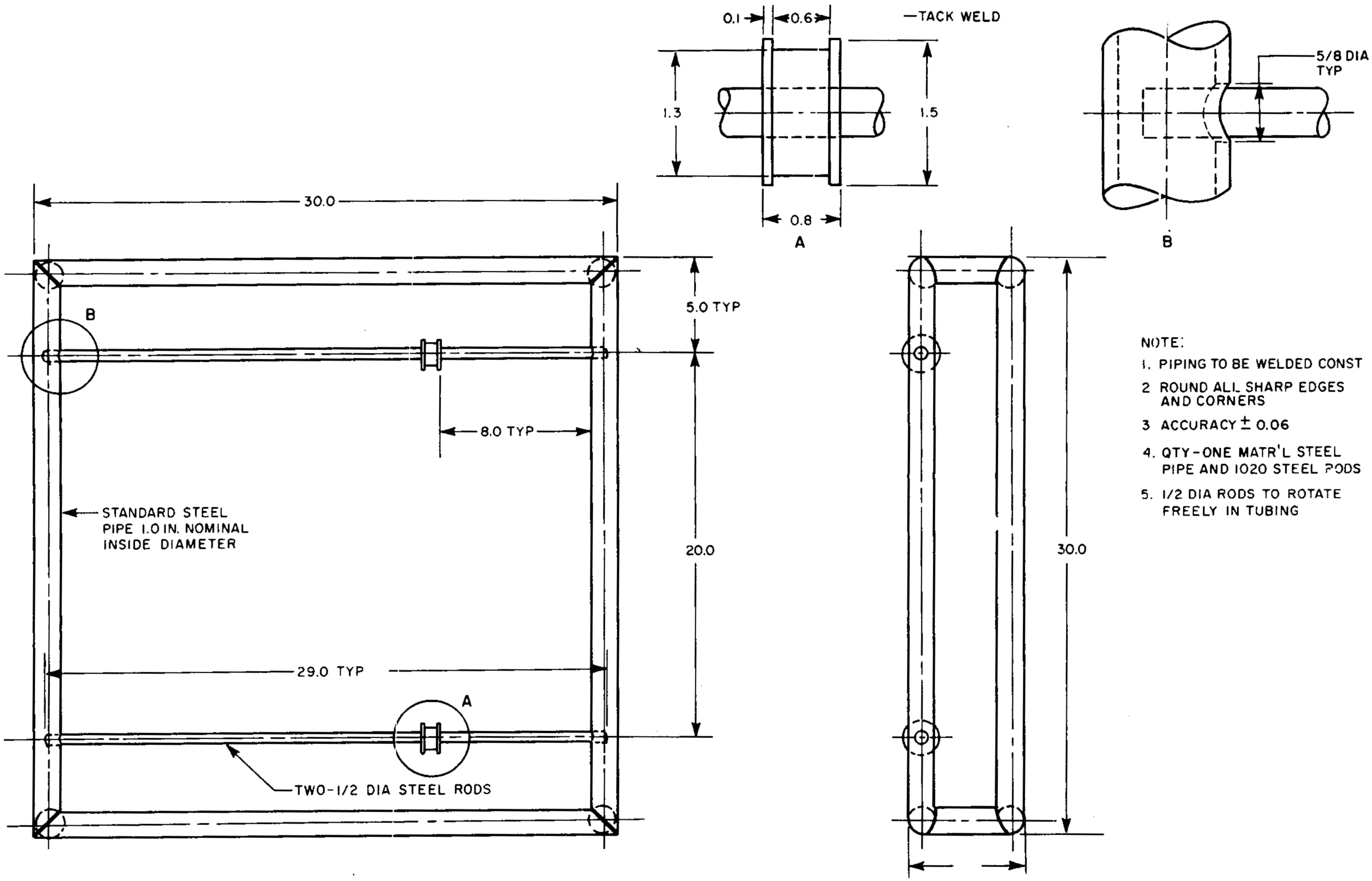


Figure 36 STERILIZATION CONTAINER HANDLING FIXTURE

5.4 INSTRUMENTATION AND DATA HANDLING

5.4.1 Instrumentation Locations

Figure 37 shows the location of the strain gages, thermocouples, and linear potentiometers. There will be 27 Baldwin-Lima-Hamilton Company FABX-25-12S13, constantan foil, bakelike base, biaxial strain gages used on the container. The container and probe assembly will be instrumented with 30 copper-constantan thermocouples, 24 gage wire. Nine linear potentiometers will be installed within the container. The support flange will be the reference point for all deflection measurements.

5.4.2 Data Handling

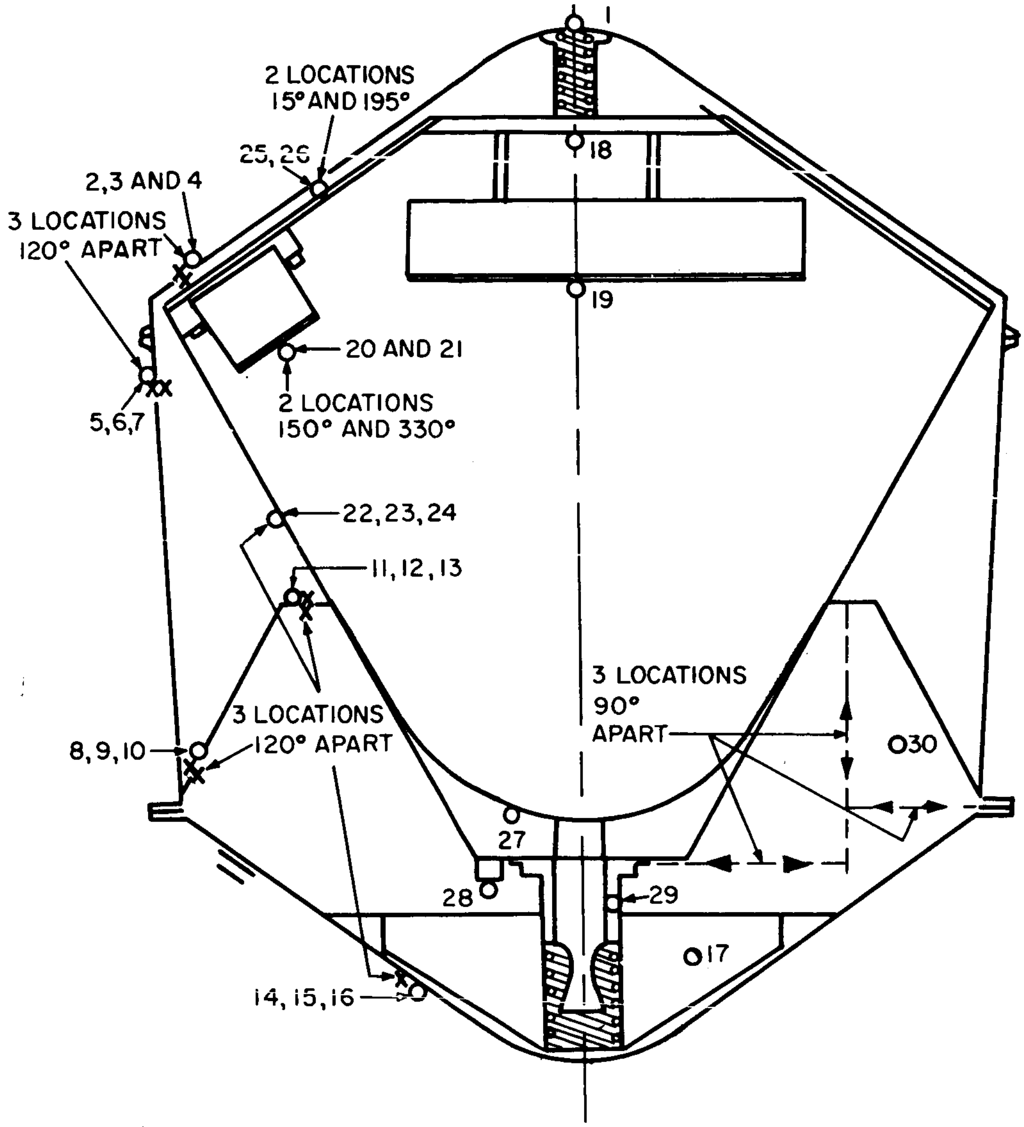
The Avco/RAD data processing staff has reviewed procedures for processing the test data obtained from the sterilization container test program. Data from thermocouples, strain gages and linear potentiometers will be acquired by a 100-channel data logger and printed out on a strip listing at 10 minute intervals in the format shown below.

	Time	(Annotated)	
Channel Number	XX	O X X X X	strain or millivolt reading with sign
	99	O X X X X	

These data will be key-punched onto IBM cards for computer entry. Computer programs will perform the following operations:

1. Thermocouples - printout in OXX.XX millivolts will be calibrated to temperature (T) using table lookup.

2. Strain gages - printout in OXXXX microinches/inch will be corrected for temperature effects using table lookup for the temperature measured at the gages.



X 27 BIAXIAL STRAIN GAGES
BLN FABX-25-12313

O 30 COPPER-CONSTANTAN THERMOCOUPLES
24 WIRE GAGE

9 LINEAR POTENTIOMETERS

Figure 37 INSTRUMENTATION LOCATIONS

3. Stress - for each pair of strain gages the stress will be calculated from $S = K (E_1 + k E_2)$ where E_1 and E_2 are the corrected strain values.

4. Linear Potentiometers - printout in)XX. XX millivolts will be calibrated using linear mx + n calibration

5. Calibrated time history plots of the above functions will be made on the SC-4020.

5.5 CONCLUSIONS AND RECOMMENDATIONS

The need for a 36-hour dwell time during the second and third heat sterilization cycles, and the possibility of reducing the dwell time to 5 hours during these tests should be considered. Analysis indicates that stresses during the sterilization cycle are low and since strain gage errors become a larger percentage of the total reading values, instrumentation should be reviewed and possibly modified to produce the most meaningful data. Consideration is being given to including more temperature, and less strain gage, sensors.

DISTRIBUTION

Addressee	No. of Copies
Purchasing Office, NASA, George C. Marshall Flight Center, Huntsville, Alabama (+ 1 reproducible	12
Research Library (+ 1 reproducible)	3
Central Files	1
G. Kropa	35